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2012 Portland Metropolitan Region Transportation System Performance Report

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PORTLAND STATE UNIVERSITY
DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING
PORTLAND SUSTAINABLE TRANSPORT LAB

2012
Portland Metropolitan Region Transportation System Performance Report

October 2013

Portland State
UNIVERSITY

Table of Contents

Acknowledgement

The original version of this report is based on the *Statewide Congestion Overview*, prepared by Alex Bigazzi and Brian Gregor of the Oregon Department of Transportation in February 2004. This report draws from that work, including some data and methodologies. The graphical technique used to show Portland, peer western cities, and the remaining comparison metropolitan areas was originally conceived in the *Statewide Congestion Overview*. This technique has been replicated for new graphics produced in this report. The *Statewide Congestion Overview* is the inspiration for this report and is available at:
http://www.its.pdx.edu/pdf/CongestionOverview021704.pdf

We gratefully acknowledge the Texas Transportation Institute (TTI) for providing us the 2012 Urban Mobility Report (2011 data) for use in this report.

In addition, we sincerely appreciate the input and assistance provided by our other regional and statewide partners including the Oregon Department of Transportation, Metro, TriMet, the City of Portland and the Port of Portland.

Contributors

Robert L. Bertini and Deanna George prepared this report, with assistance in final formatting by Matthew Downey. We acknowledge Alex Bigazzi and Brian Gregor, Oregon Department of Transportation as primary contributors, since we used data, methodologies and graphical techniques developed in the *Statewide Congestion Overview* (February 2004) which they authored. Nick Carey, Sonoko Endo, Christopher Monsere, Jennifer Dill and Jacob Baglien, Portland State University assisted with the earlier versions of this report. Any views presented here, or any errors or omissions are solely the responsibility of the authors.

Previous versions of this report:
2004: http://www.its.pdx.edu/upload_docs/1250525944.pdf
2006: http://www.its.pdx.edu/upload_docs/1248894224wS3CbkBmJj.pdf
2008: http://www.its.pdx.edu/upload_docs/1248894236SUbybsmxpk.pdf
2010: not prepared

Preface

Our transportation system is a key ingredient in the economy, quality of life and urban fabric of the Portland metropolitan area. It has been stated in the past that it is not possible to manage our transportation system tomorrow unless we understand how it is performing today. In this spirit, Portland State University has been working with regional and statewide partners to develop new capabilities to measure, monitor and track the performance of the transportation system in real time and using archived data sources. We believe that it is possible to leverage these disparate data sources toward providing better transportation system performance information for planners, engineers, citizens, researchers and decision-makers. Using this information, we can collaboratively develop policies and programs that can help make our transportation system more efficient, equitable and effective.

With this in mind, we are pleased to present the 2012 Portland Metropolitan Region Transportation System Performance Report. We have attempted to make this report comprehensive and multimodal in spirit. We truly view this as a starting point, a work in progress, and we intend to continue to improve the content and format of this report in years to come. Of the new charts that were added for this years' report, several relate to environmental health or sustainability (air quality, drive-alone commuters, etc.). We are also in the process of developing other "green" performance measures such as motor vehicle emissions, fuel consumption, and person-miles traveled. These new performance measures will appear in future versions of this report.

We strive to stimulate and conduct multidisciplinary research on transportation issues, facilitating the dissemination of information and encouraging the implementation of research results. We welcome both comments on this report and participation in our programs and activities from all interested parties. We invite you to visit our website at http://transportation.research.pdx.edu/, and thank you in advance for your interest and input.

Robert L. Bertini, Ph.D., P.E.
Professor of Civil & Environmental Engineering
Portland State University

Comparing Urban Areas

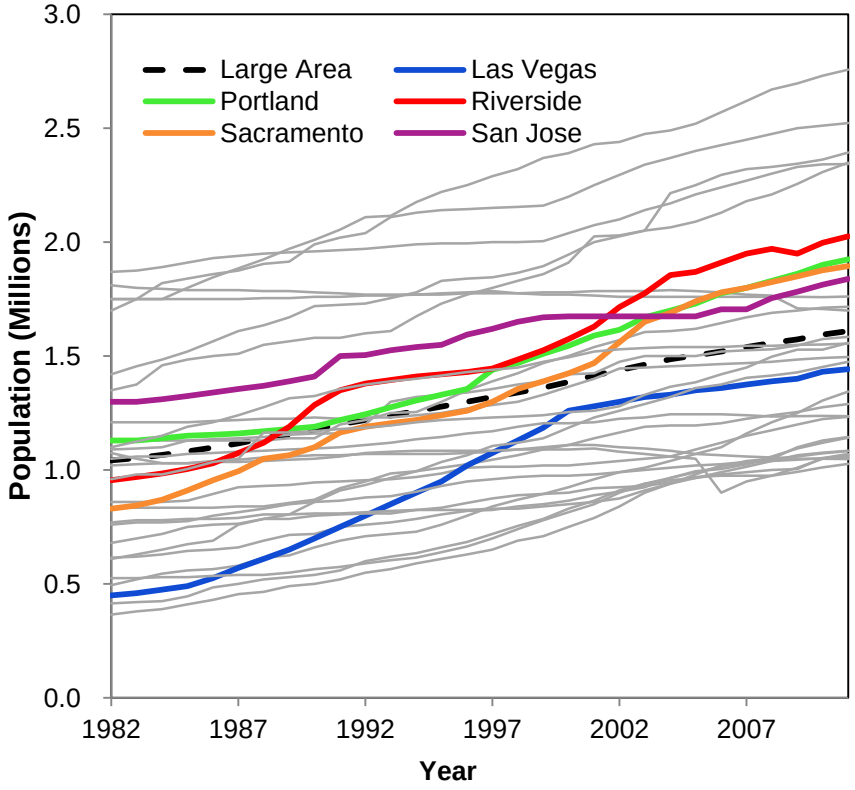
Using methods suggested by the 2004 Statewide Congestion Overview, this section examines ways that urban areas are compared using national-level data sources.

Comparing Urban Areas

Large Urban Areas:

- Nashville-Davidson, TN
- Denver-Aurora, CO
- Orlando, FL
- Austin, TX
- Las Vegas, NV
- Portland-Vancouver, OR-WA
- Virginia Beach, VA-NC
- Baltimore, MD
- Indianapolis, IN
- Charlotte, NC-SC
- Columbus, OH
- Pittsburgh, PA
- San Jose, CA
- Memphis, TN-MS-AR
- Riverside-San Bernardino, CA
- San Antonio, TX
- Tampa-St Petersburg FL
- Cincinnati, OH-KY-IN
- Louisville, KY-IN
- Minneapolis-St Paul, MN-WI
- Buffalo, NY
- Sacramento, CA
- Cleveland, OH
- St Louis, MO-IL
- Jacksonville, FL
- Providence, RI-MA
- Salt Lake City, UT
- Milwaukee, WI
- New Orleans, LA
- Kansas City, MO-KS
- Raleigh-Durham, NC

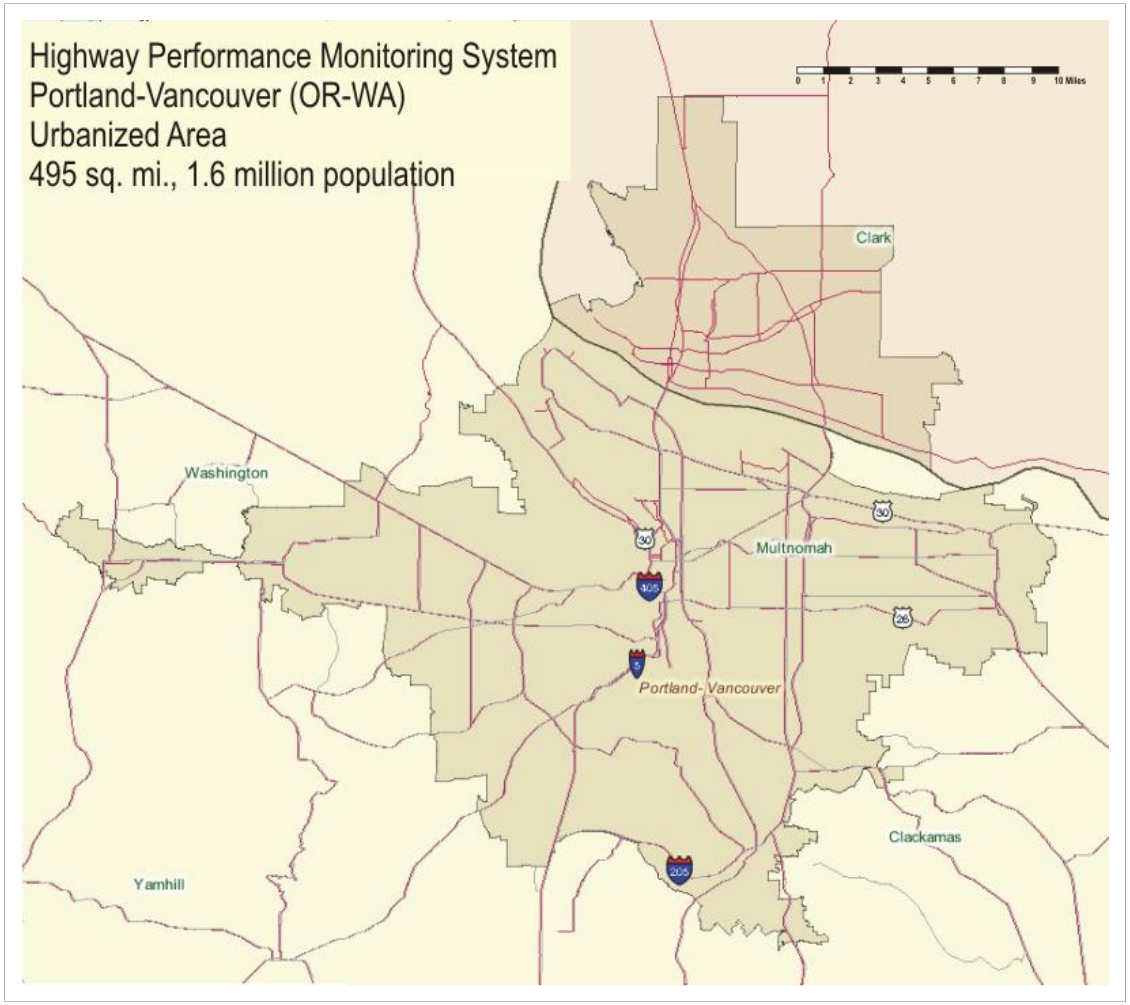
The Texas A&M Transportation Institute's annual Urban Mobility Report categorized each urban area by size. In this study, we compare the Portland region to other urban areas in the Large category (populations of 1-3 million people). The 31 Large areas are listed on this page to the left. Data reported are through the year 2011. Because of population growth, San Diego has moved up to a larger group size, and others have moved up into this category. Revisions were also made to the Urban Mobility Report methodology, affecting the way measures were collected and calculated.



When graphically comparing Large urban areas from the Urban Mobility Report, the colored lines are for the six western cities: Las Vegas, Riverside-San Bernardino, Sacramento, San Diego, San Jose, and Portland. In the sample plot shown here, the grey lines are for the remaining cities in the Large category, and the dashed black line represents the average value measured across all 25 Large cities.

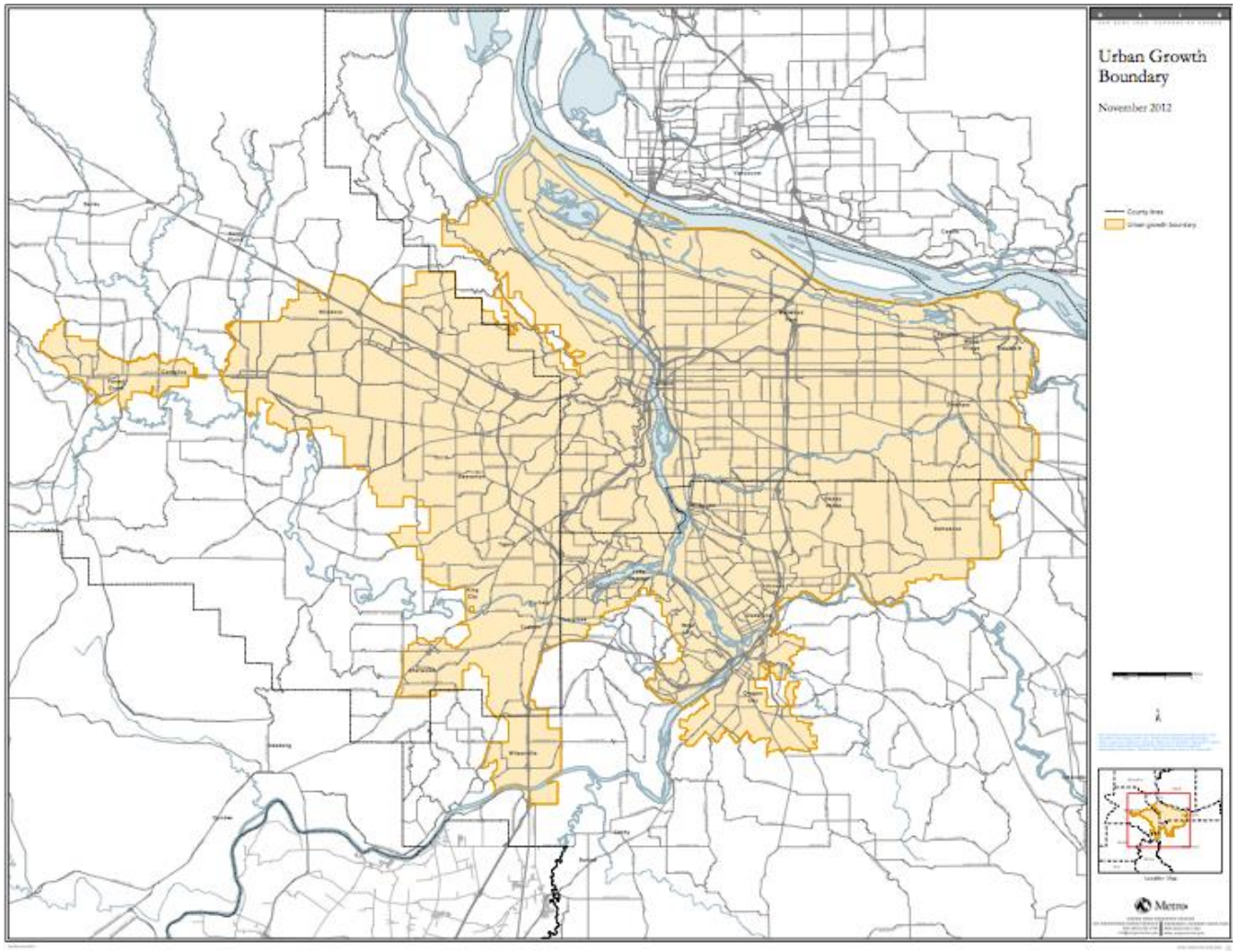
Portland-Vancouver Urbanized Area

This map shows the Portland-Vancouver Urbanized Area, which is used by the Federal Highway Performance Monitoring System (HPMS). The data reported by the Urban Mobility Report includes estimates of travel, population, and land area for this area (different than the area inscribed by the Urban Growth Boundary or the U.S. Census). Changing the boundary of this area would change the results of the Urban Mobility Report.



Urban Growth Boundary

In contrast to the map of the Portland-Vancouver urbanized area, this map shows the Metro 2006 Urban Growth Boundary.

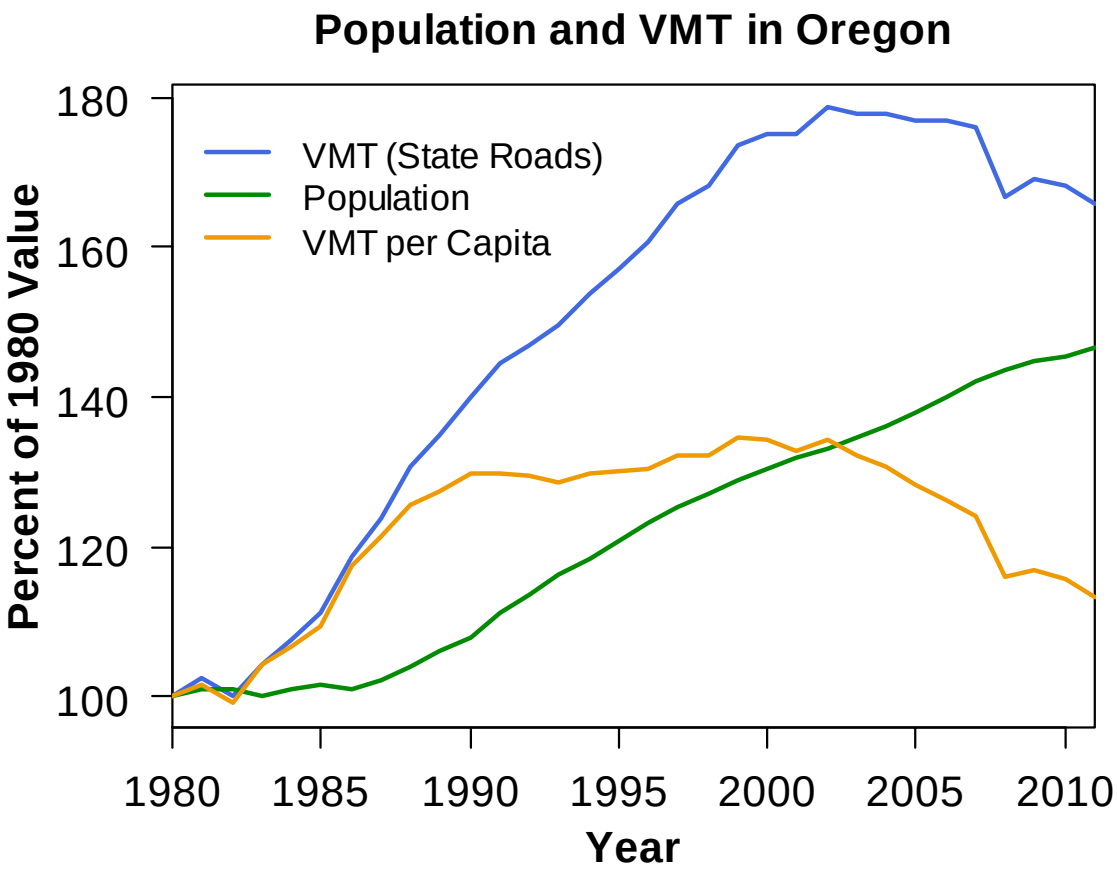


State of Oregon Trends

Using methods suggested by the 2004 Statewide Congestion Overview, this section examines trends on a statewide basis.

Oregon Population and Vehicle Miles Traveled

Oregon saw an increase in traffic on major roads in urban areas of about 75 percent between 1980 and 2005. However, VMT has since been declining. Although population continues to grow, VMT per capita has continued to decline since 2002.

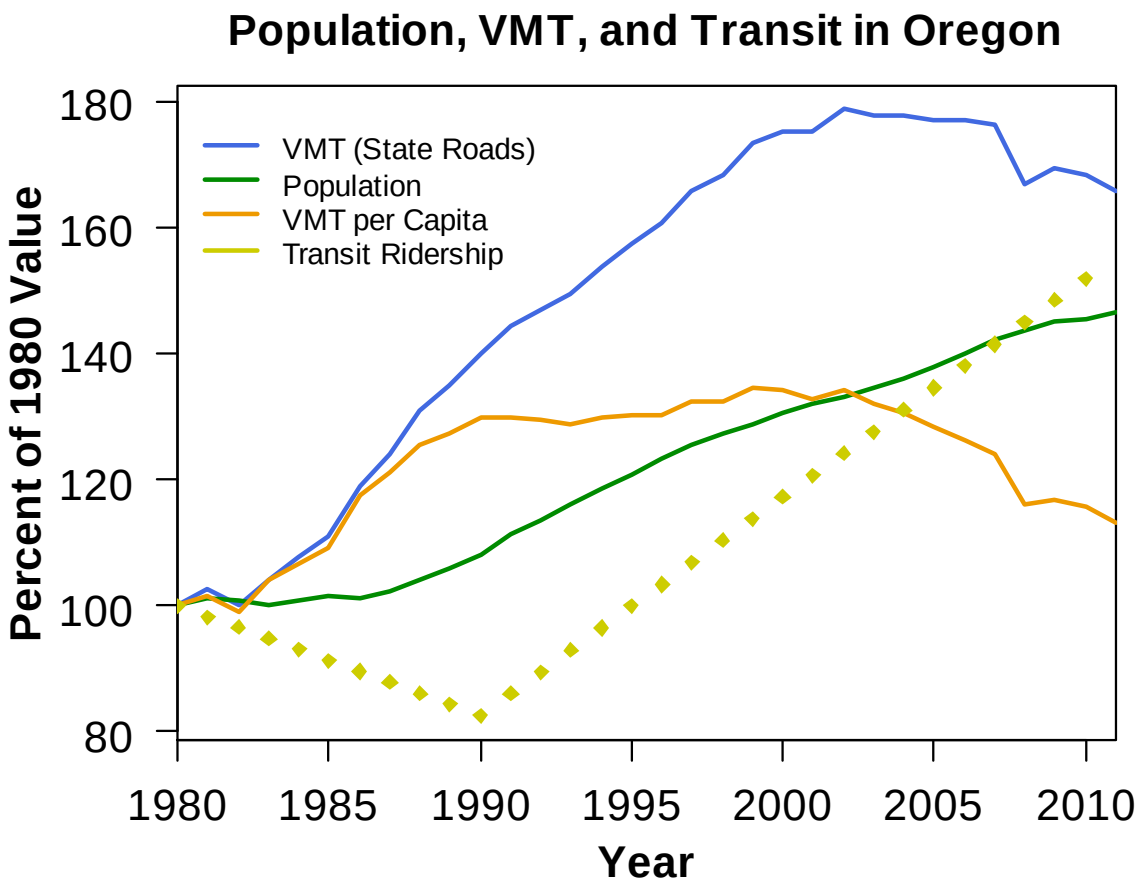


Data Sources: VMT - ODOT; Population - Portland State University Population Research Center

(Figure 1-1)

Oregon Population, Vehicle Miles Traveled and Transit Ridership

In addition to what was shown on the previous page, this graph shows that transit ridership (work trips) decreased between 1980 and 1990, and has been increasing ever since. The overall increase has been about 50 percent.



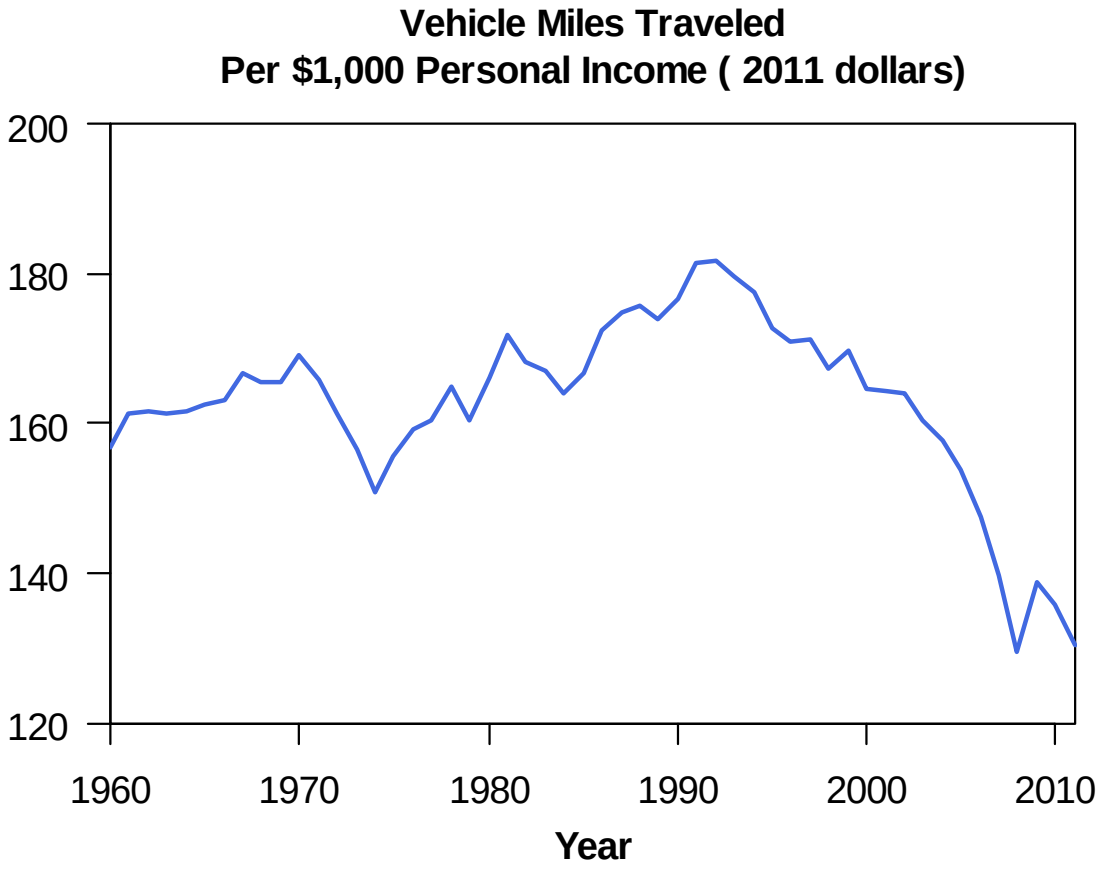
Data Sources: VMT - ODOT; Population - Portland State University Population Research Center; Transit - U.S. Census Journey to Work.

Note: Transit data for Portland-Salem CMSA, from census years only (4 data points, so trends difficult to discern)

(Figure 1-2)

Oregon VMT Related to Income

The ratio of VMT to total statewide personal income has not changed significantly over the past forty-five years. It peaked in 1991, and reached a low in 2008. These VMT values are for state-owned highways only. VMT estimates by ODOT for all Oregon roads are typically about 66 percent higher.

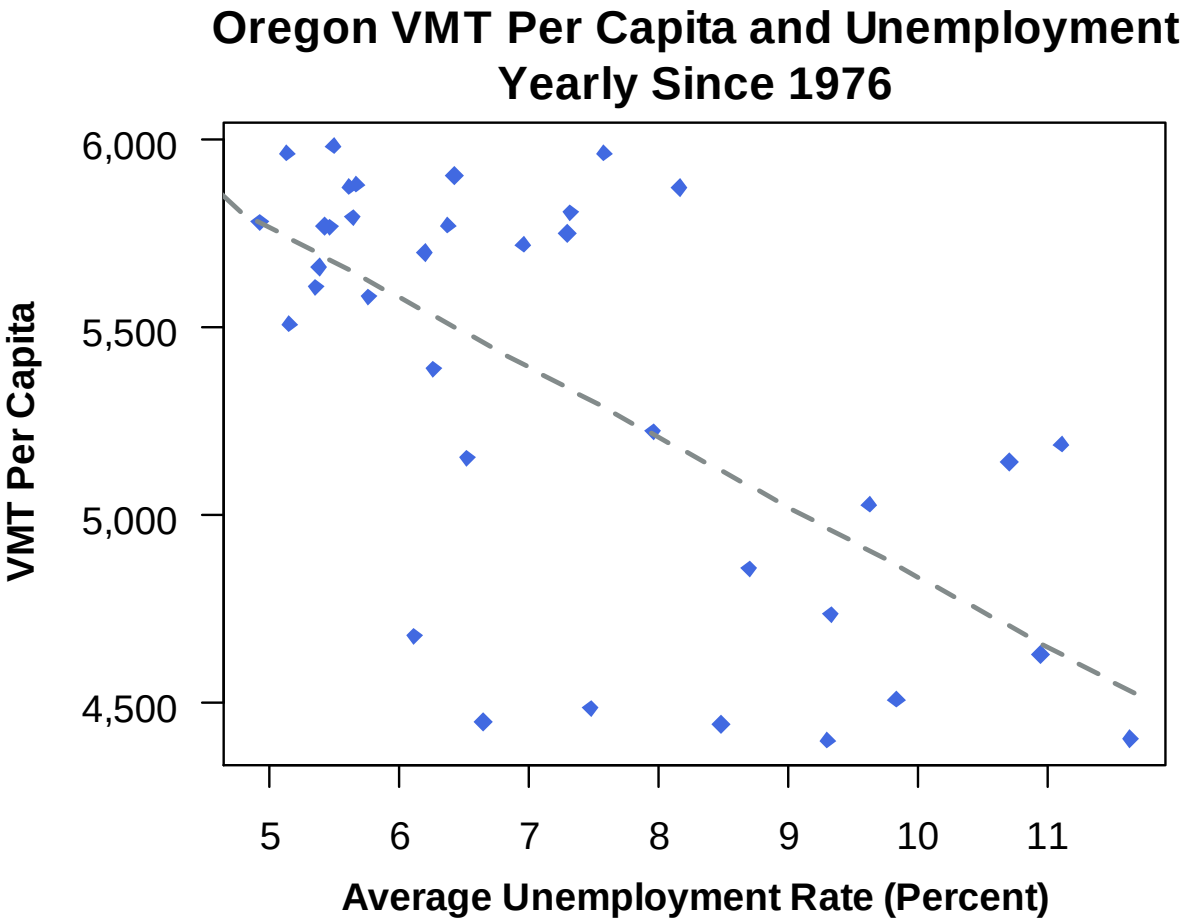


Data Sources: VMT - ODOT; Income - U.S. Bureau of Economic Analysis; CPI - U.S. Bureau of Labor Statistics

(Figure 1-3)

Oregon VMT and Unemployment

This graph shows the relationship between annual VMT per capita and annual average unemployment rate since 1976.

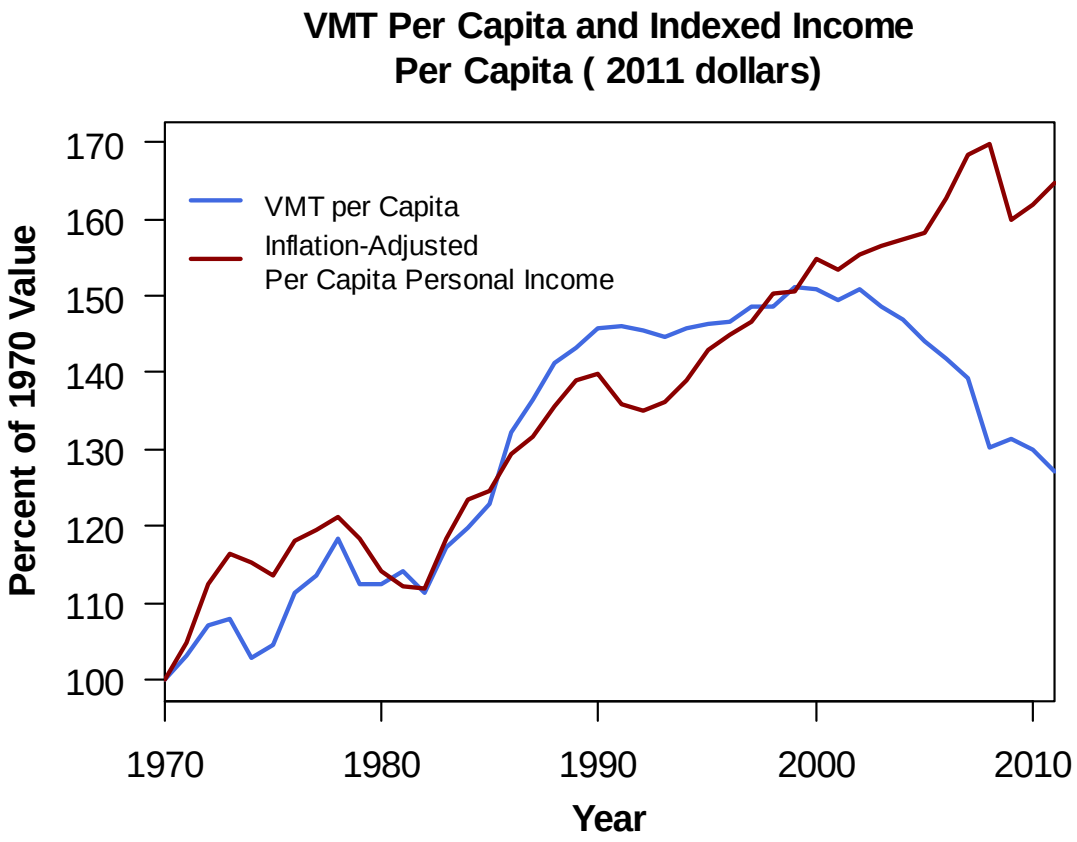


Data Sources: VMT - ODOT; Unemployment - U.S. Bureau of Labor Statistics.

(Figure 1-4)

Oregon Per Capita VMT Related to Per Capita Income

VMT per capita and indexed income per capita are shown to have similar trends of growth until 2002, when they began and continue to separate. This separation can be attributed to a variety of economic factors.

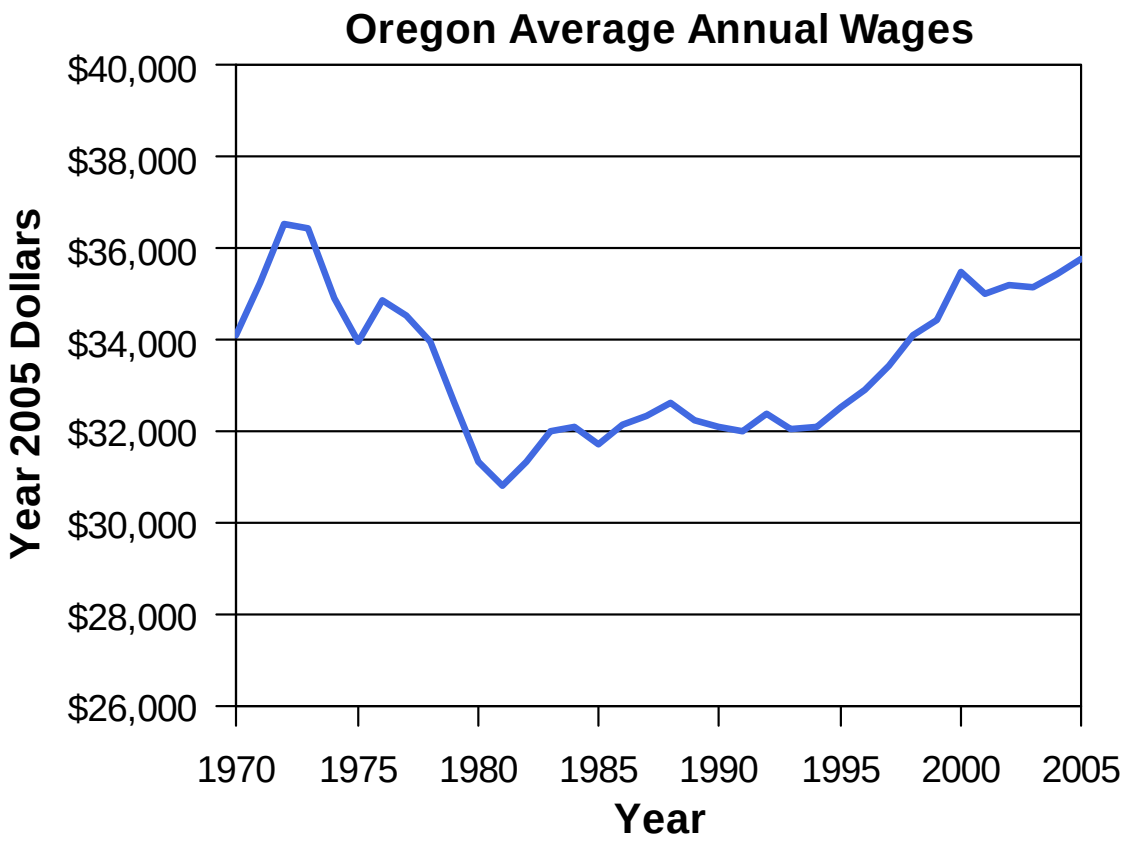


Data Sources: VMT - ODOT; Income - U.S. Bureau of Economic Analysis; CPI - U.S. Bureau of Labor Statistics

(Figure 1-5)

Oregon Average Wages

Oregonians' average annual wages (after adjusting for inflation) have not changed much over time. This is a similar conclusion to one shown in the Statewide Congestion Overview.

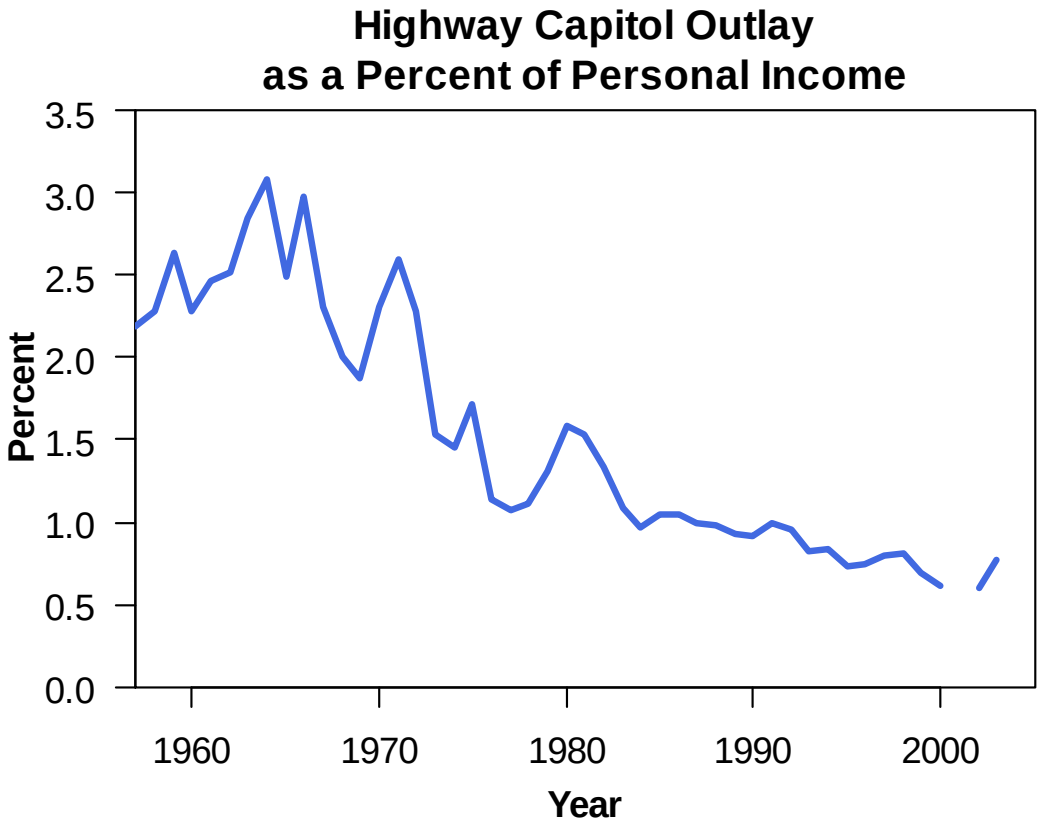


Data Sources: Income - Bureau of Economic Analysis; CPI - Bureau of Labor Statistics

(Figure 1-6)

Oregon Highway Capital Investment

The ratio of highway capital investment to statewide personal income has declined rapidly over the past 43 years. It peaked in 1968 at about 3 percent, and dropped to about 0.6 percent in 2000. As stated in the Statewide Congestion Overview (2004, p. 13) the decrease in highway capital investment increases the gap between VMT and lane-miles.

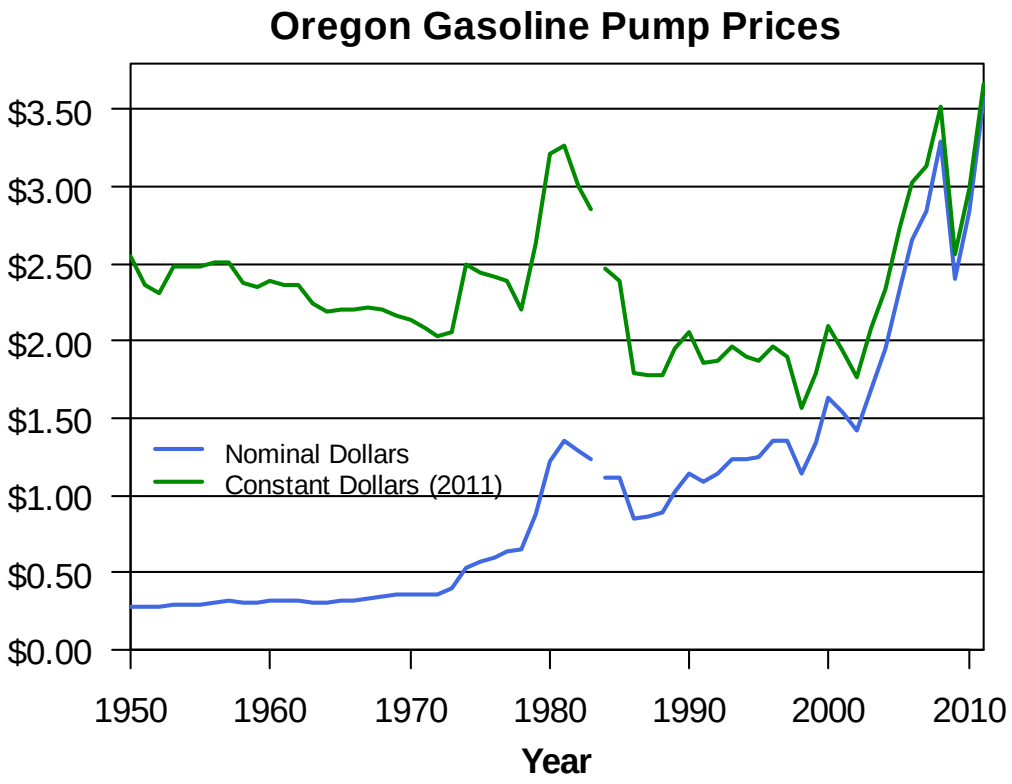


Data Sources: Personal Income - US Bureau of Economic Analysis; Capital Expenditures - Highway Statistics Summary to 1995, Table HF-202C, Highway Statistics reports for years 1996-2000, Table HF2

(Figure 1-7)

Oregon Gasoline Prices

This chart shows gasoline prices (including tax) over the past 90 years. Both the nominal and inflation-adjusted prices are presented. Until about 2001, real gasoline pump prices had been steadily decreasing, with some spikes in the 1980s. Since 1998, the trend has been heavily increasing with an all-time high in 2010.



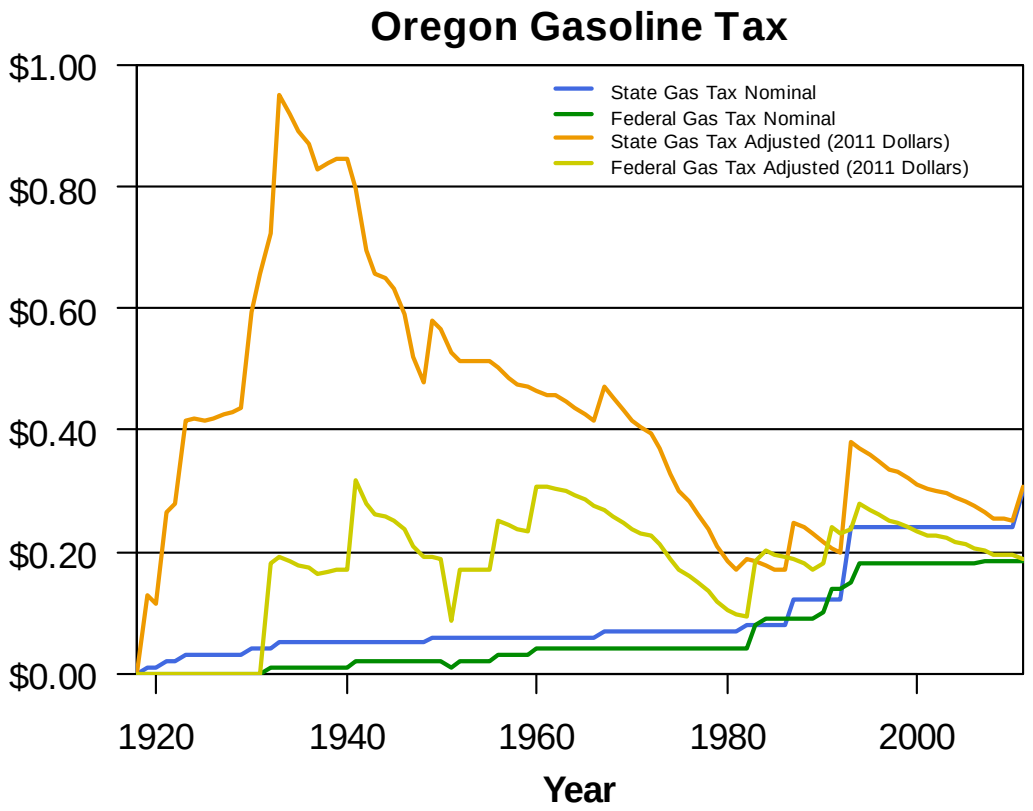
Data Sources: Income - Bureau of Economic Analysis; CPI - Bureau of Labor Statistics

Note: The discontinuity in the chart reflects different data sources for gasoline pump prices before and after 1984.

(Figure 1-8)

Oregon Gasoline Taxes

Fuel taxes (federal and state) are calculated as a fixed number of cents per gallon purchased. As shown, the nominal Oregon gasoline tax (currently 30¢/gallon) has increased since 1920, but has not kept up with inflation. Similarly, the federal tax (currently 18.4¢/gallon) has lost purchasing power due to inflationary effects.

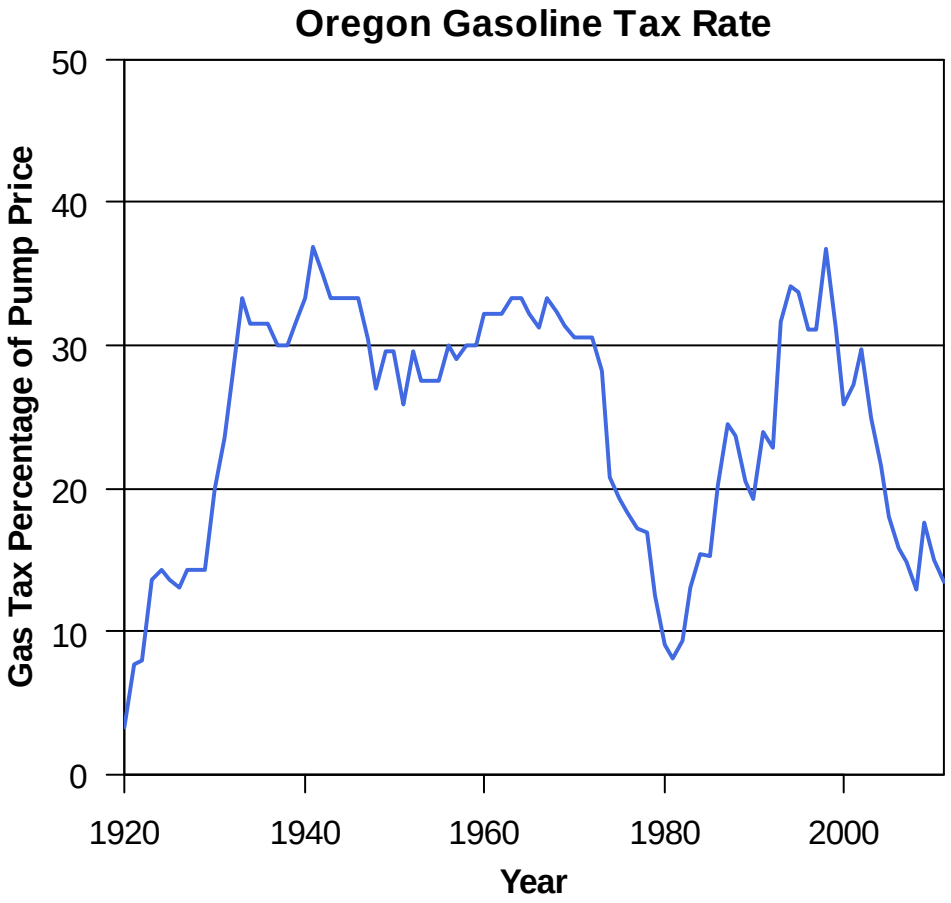


Data Sources: Gasoline Tax – American Petroleum Institute and ODOT; CPI - Bureau of Labor Statistics

(Figure 1-9)

Oregon Gasoline Tax Rate

The gasoline tax (federal and state gas taxes as a percentage of the pump price) was around 30% for much of the last century. Because gasoline taxes are a set monetary value, the gas tax rate will fall as pump prices rise.

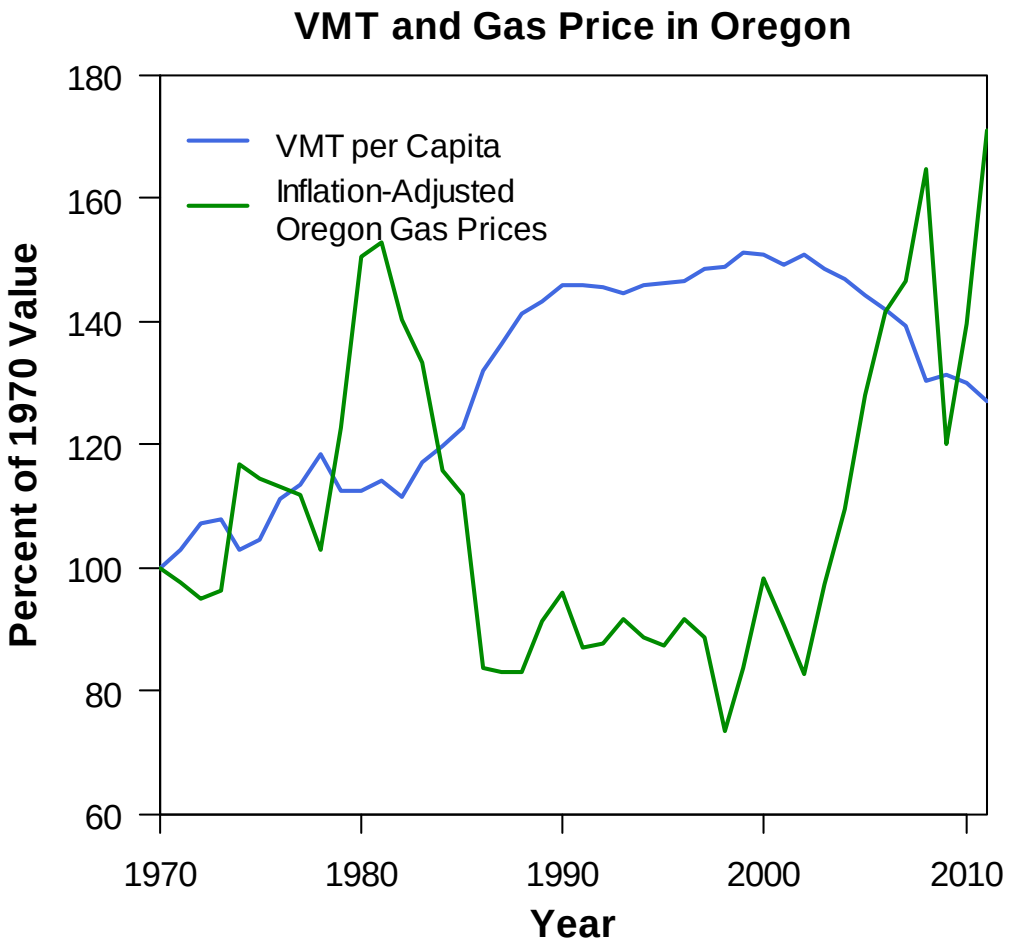


Data Sources: Gasoline Tax – American Petroleum Institute and ODOT; Pump Price – American Petroleum Institute and the U.S. Energy Information Administration

(Figure 1-10)

Oregon VMT and Fuel Prices

This chart shows the relationship between state travel per capita and gas pump prices since 1970.

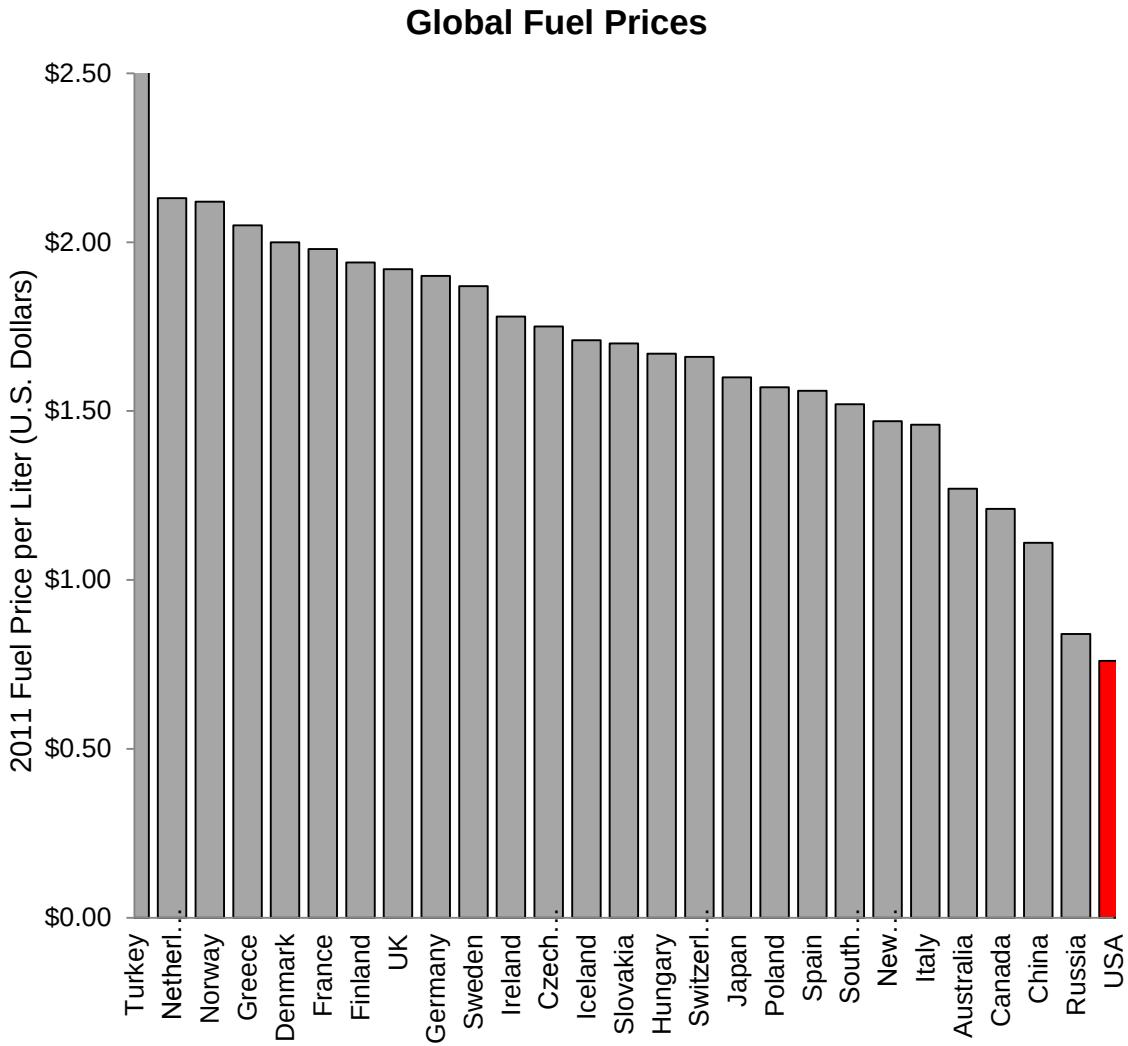


Data Sources: VMT – ODOT; Pump Price – American Petroleum Institute and the U.S. Energy Information Administration

(Figure 1-11)

International Fuel Prices

For an international perspective, this chart shows that as of 2011, the United States has significantly lower fuel prices than most other countries.

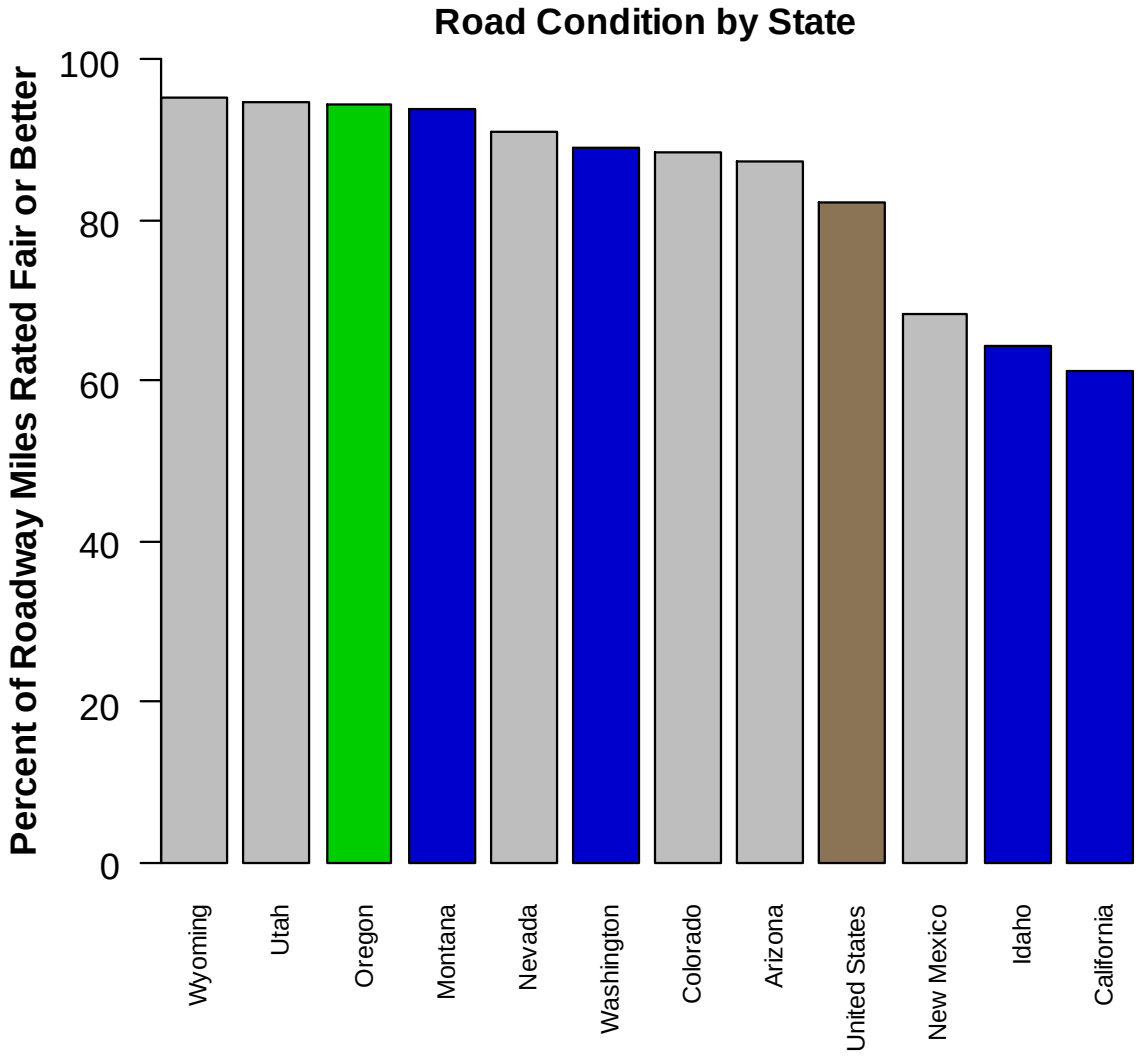


Data Source: Federal Ministry for Economic Cooperation and Development (Germany)

(Figure 1-12)

Road Conditions by State

This chart shows that the condition of Oregon roads compares well to the 10 other Western states and the U.S. average, as of 2005. The rating system classifies roadways as Very Good, Good, Fair, Mediocre, and Poor, based on the International Roughness Index and the Present Serviceability Rating. Higher values are better.

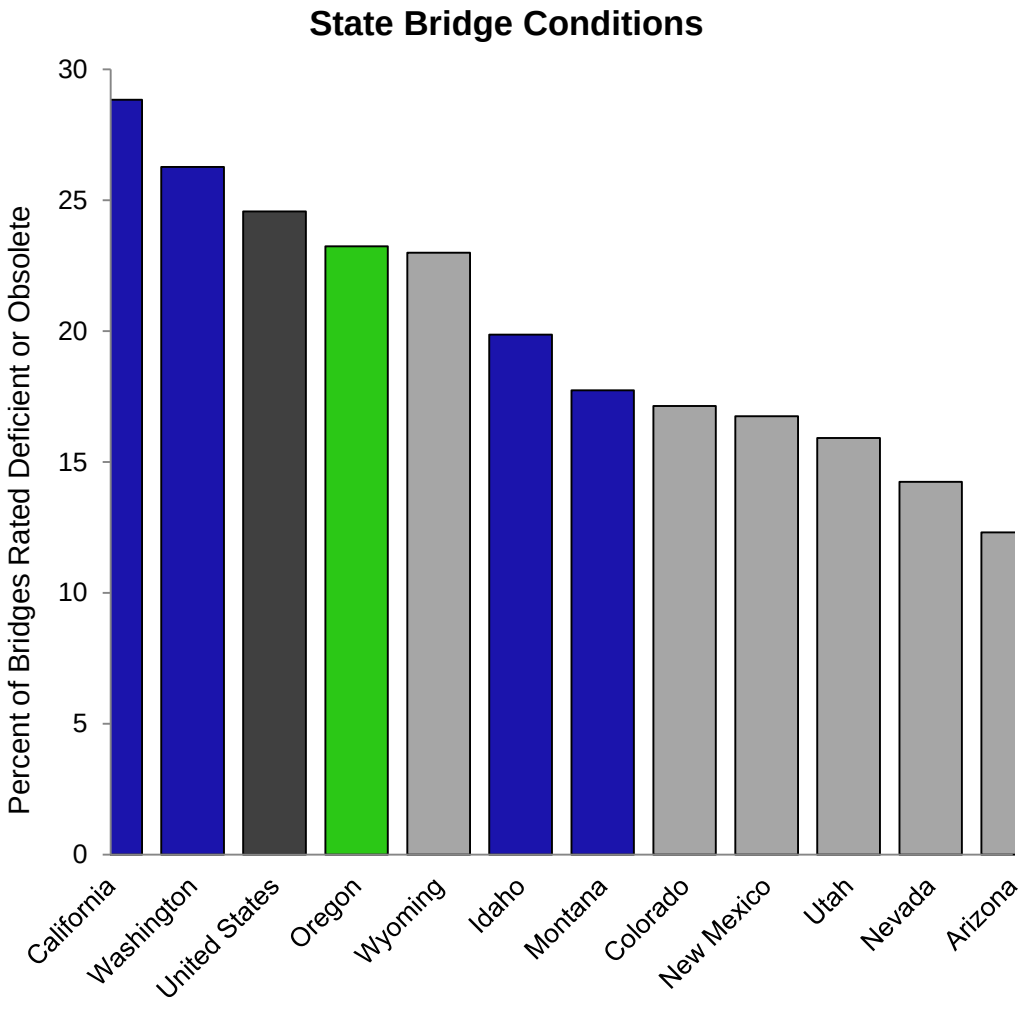


Data Source: Federal Highway Administration

(Figure 1-13)

Bridge Conditions by State

This chart shows the percent of bridges rated structurally deficient or functionally obsolete for 11 Western states and the U.S. average. Lower values are better. Oregon rates slightly better than the national average and the other Pacific Coast states. Still, nearly one quarter of Oregon bridges are deficient or obsolete as of 2012.

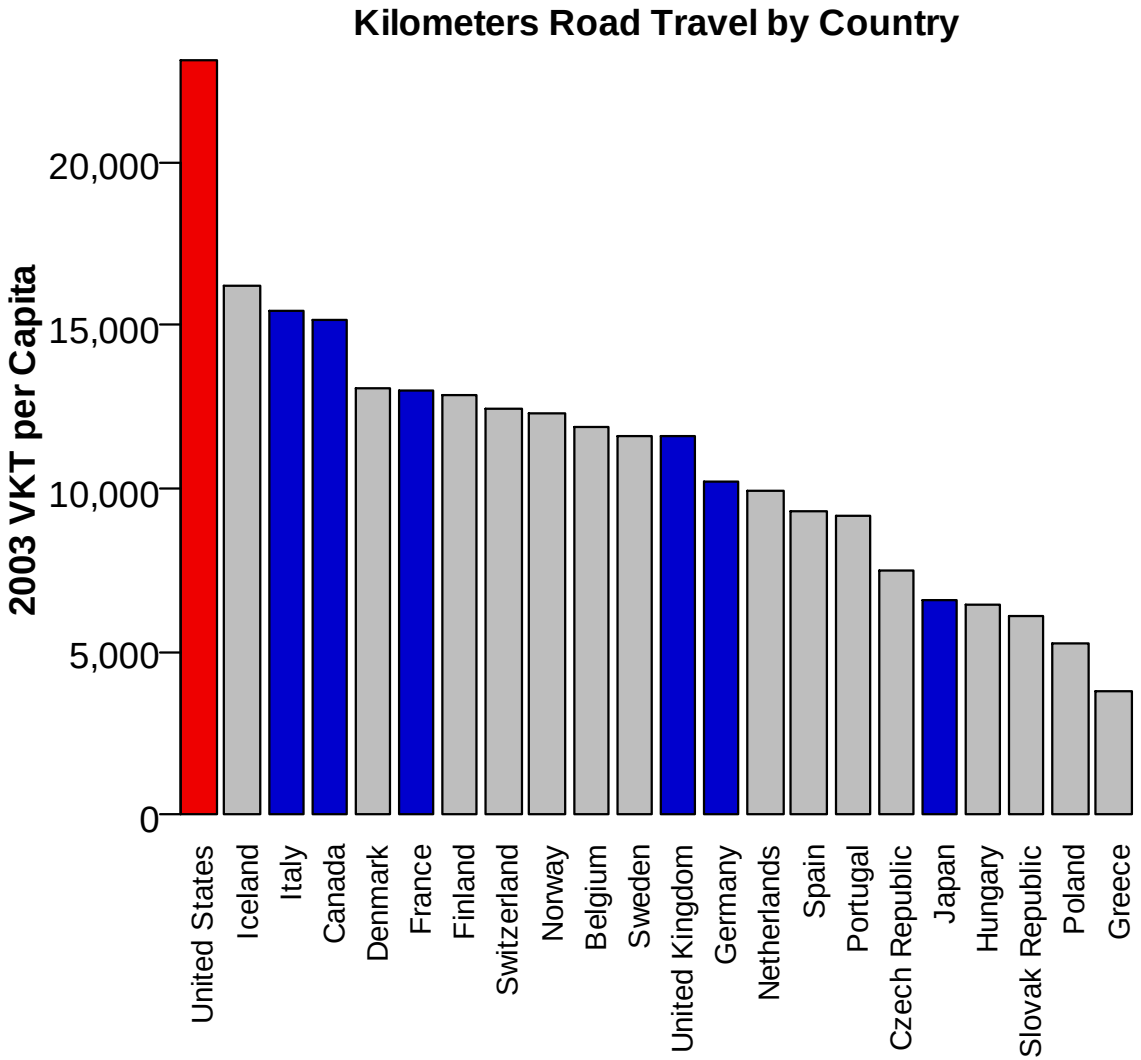


Data Source: Federal Highway Administration

(Figure 1-14)

International Vehicle Travel Per Capita

For an international perspective on driving volume, this chart shows annual Vehicle Kilometers Traveled per capita in 2003. VKT includes road travel by both private car and bus. The United States had significantly more travel per person than other countries shown here. The countries coded blue are part of the G8 (without Russia).

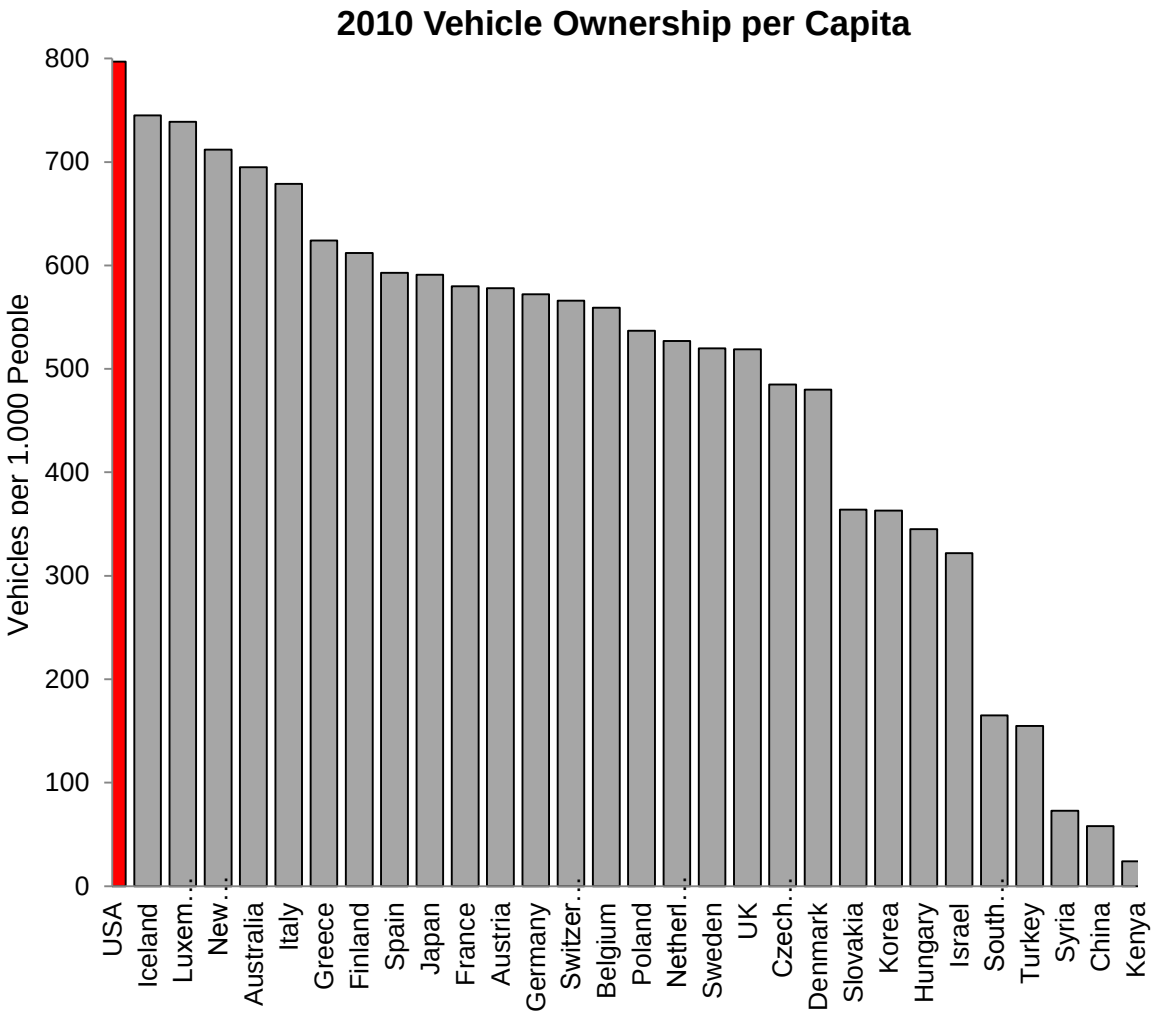


Data Source: Organisation for Economic Co-Operation and Development

(Figure 1-15)

International Vehicle Ownership per Capita

This figure shows that as of 2010, the United States had the most motor vehicles per capita of the countries shown here. A high vehicle ownership rate partly explains the high VKT per capita shown on the previous page.



Data Source: The World Bank

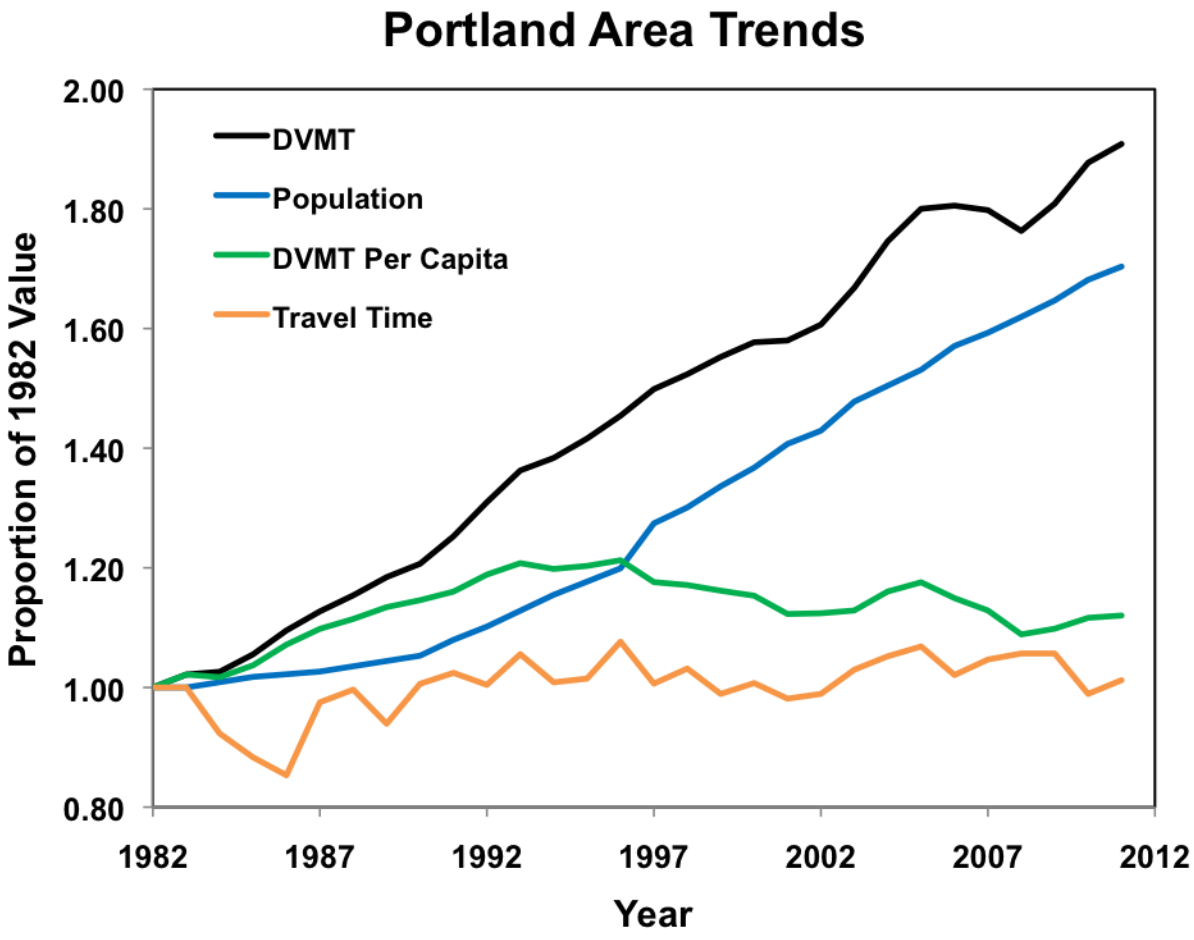
(Figure 1-16)

Portland Metropolitan Region Trends

Using methods suggested by the 2004 Statewide Congestion Overview, this section examines trends observed in the Portland Metropolitan Region.

Portland Metropolitan Region Trends

This figure shows the proportion change in daily VMT, total annual travel time in peak periods, and population in Portland-Vancouver urbanized area. With growth in population and the Oregon economy, DVMT has increased.

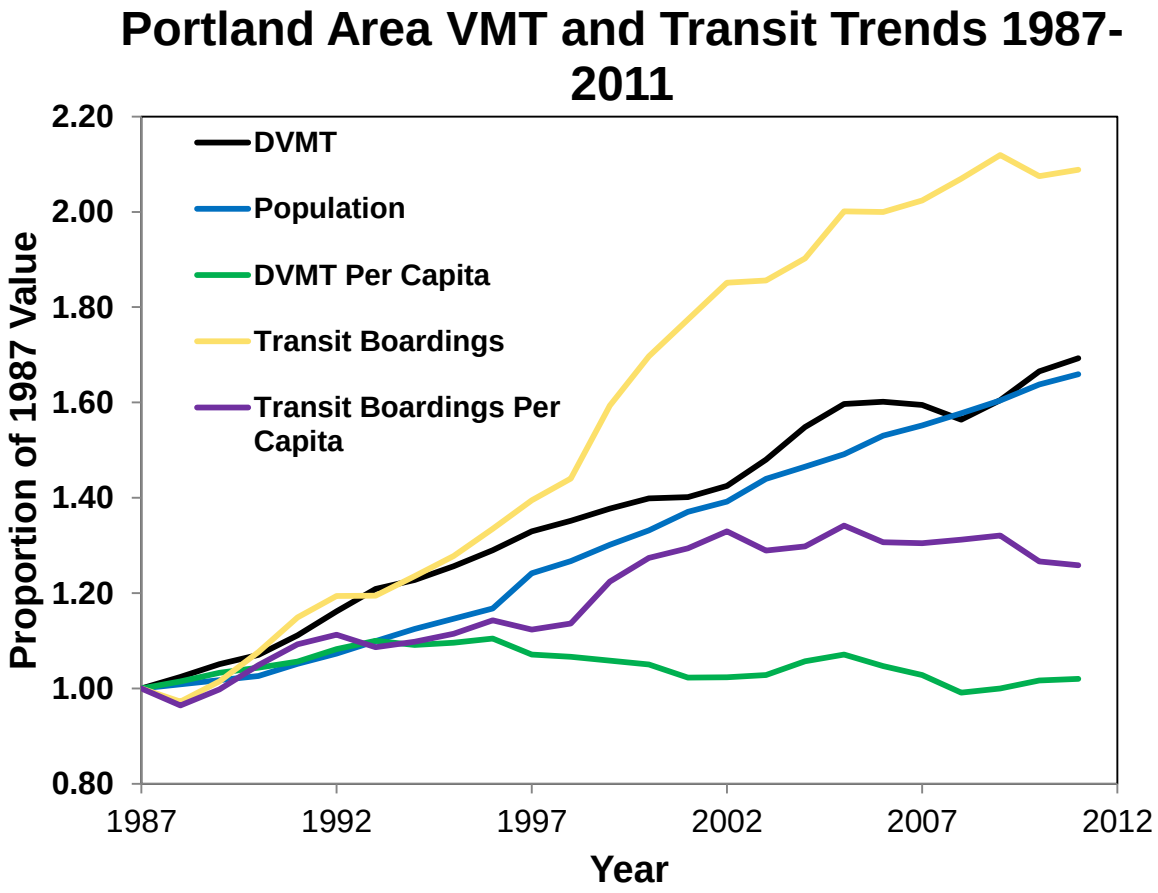


Data Sources: DVMT and Lane Miles - 2012 Urban Mobility Report

(Figure 2-1)

Portland Area VMT and Transit Trends

This figure shows the proportion changes in VMT per capita, transit boardings and transit boardings per capita in the Portland-Vancouver urbanized area.

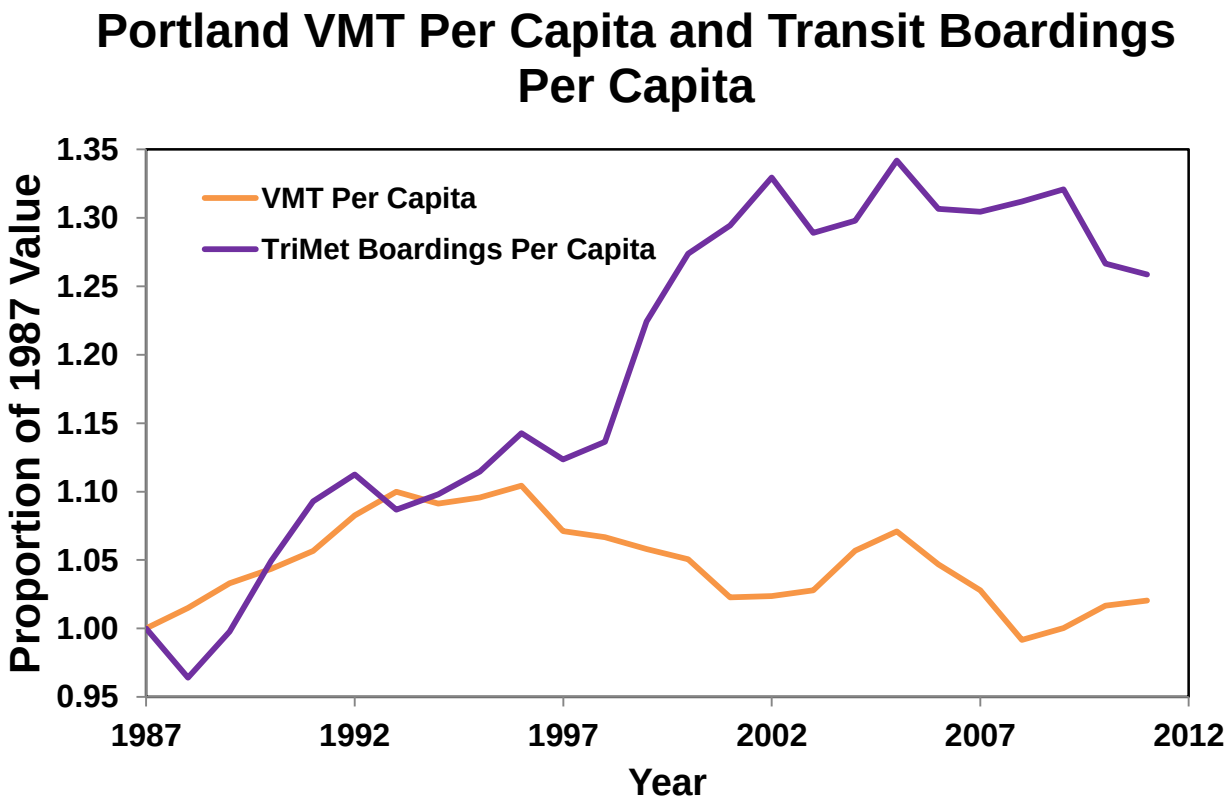


Data Sources: VMT, Population, Size, Speed & Travel Time - 2012 Urban Mobility Report; Transit Boardings - TriMet

(Figure 2-2)

Portland Area Per Capita VMT and Transit Trends

This figure shows the proportion changes in VMT per capita, and TriMet transit boardings per capita in the Portland-Vancouver urbanized area.

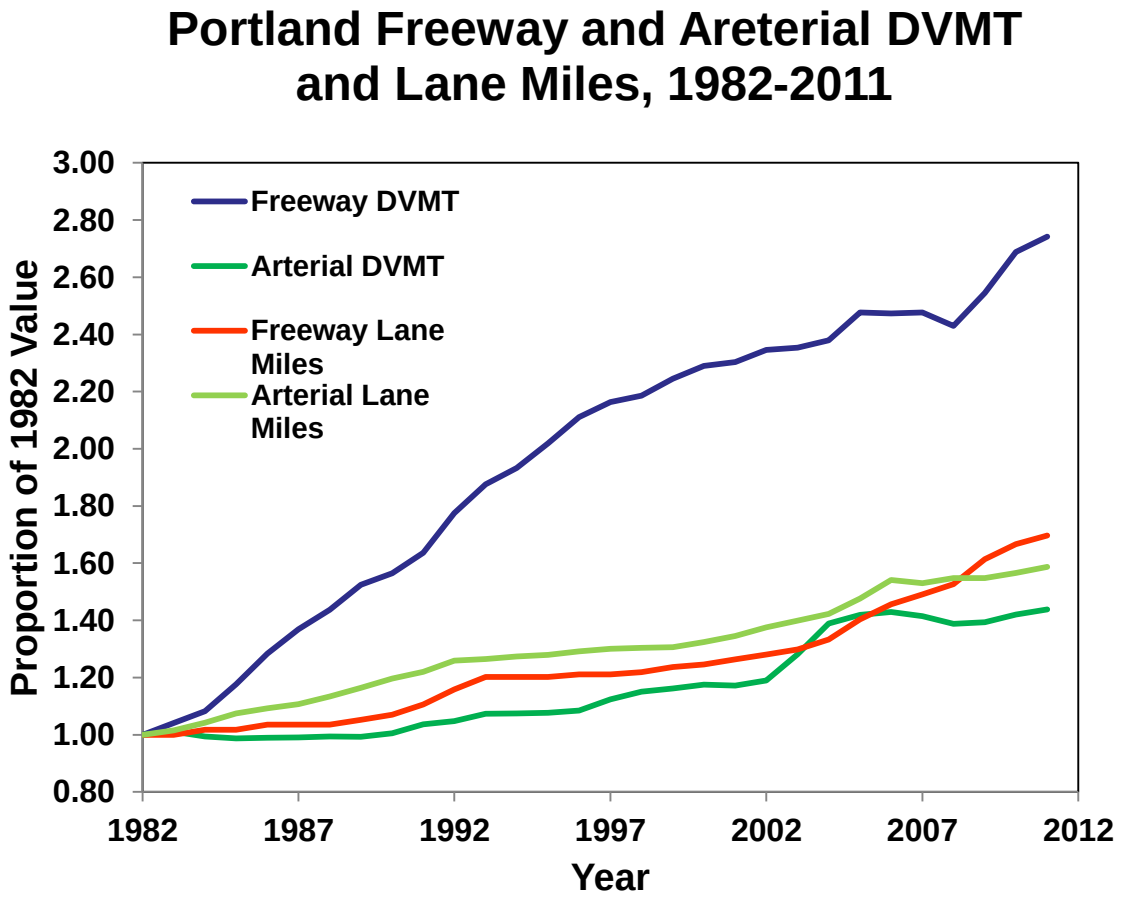


Data Sources: VMT, Population, Size, Speed & Travel Time - 2012 Urban Mobility Report; Transit Boardings - TriMet

(Figure 2-3)

Portland Daily Freeway and Arterial VMT and Lane Miles

Daily VMT on freeways increased dramatically between 1982 and 2011. Lane miles on arterials have been added at a rate greater than the increase in VMT. However, lane miles on freeways have increased by only 44 percent since 1982.



Data Sources: DVMT and Lane Miles -2012 Urban Mobility Report

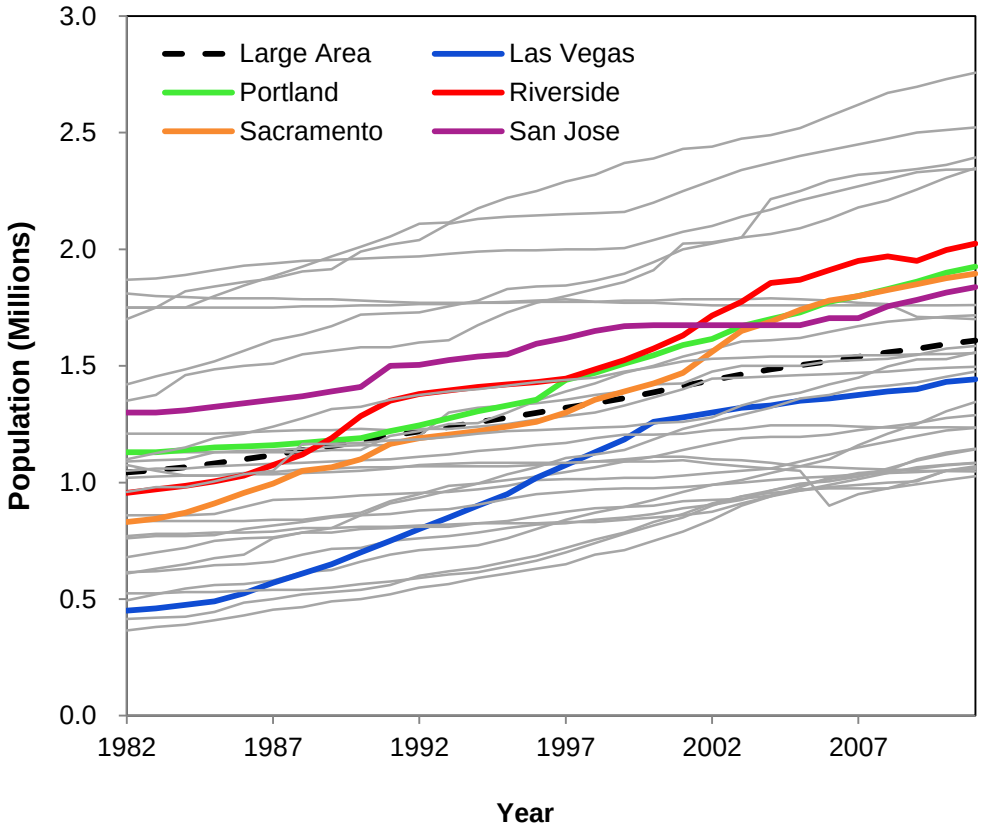
(Figure 2-4)

Comparing Portland to Other Large Urban Areas

Using methods suggested by the 2004 Statewide Congestion Overview, this section compares Portland to other Large urban areas. The following charts highlight the five Western cities in this size category.

Population Trends

This is a comparison of population growth among Large urbanized areas with population between 1 and 3 million. The Portland-Vancouver area has a population growing above the group average. Populations in most cities have increasing trends with about the same rates.

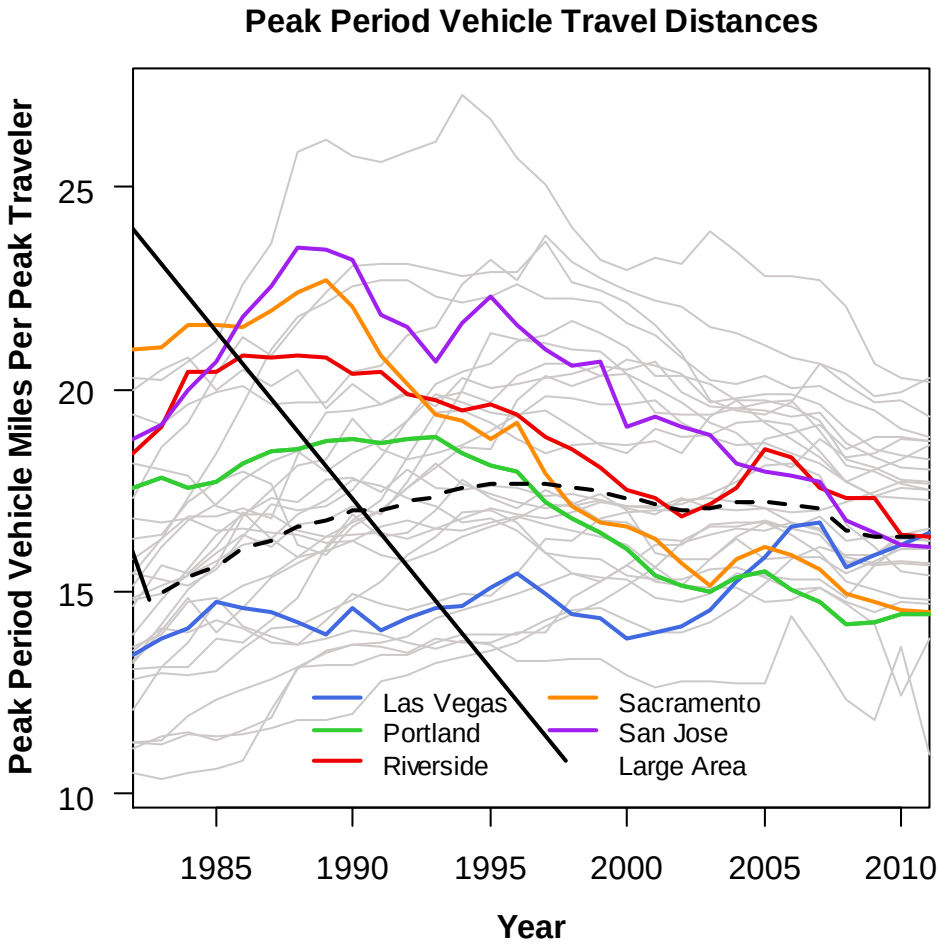


Data Source: 2012 Urban Mobility Report

(Figure 3-1)

Travel Distance Trends

This figure shows average daily travel distances per peak period traveler on the major road system (freeways and arterials). Peak period travelers in Portland drive shorter distances than average.

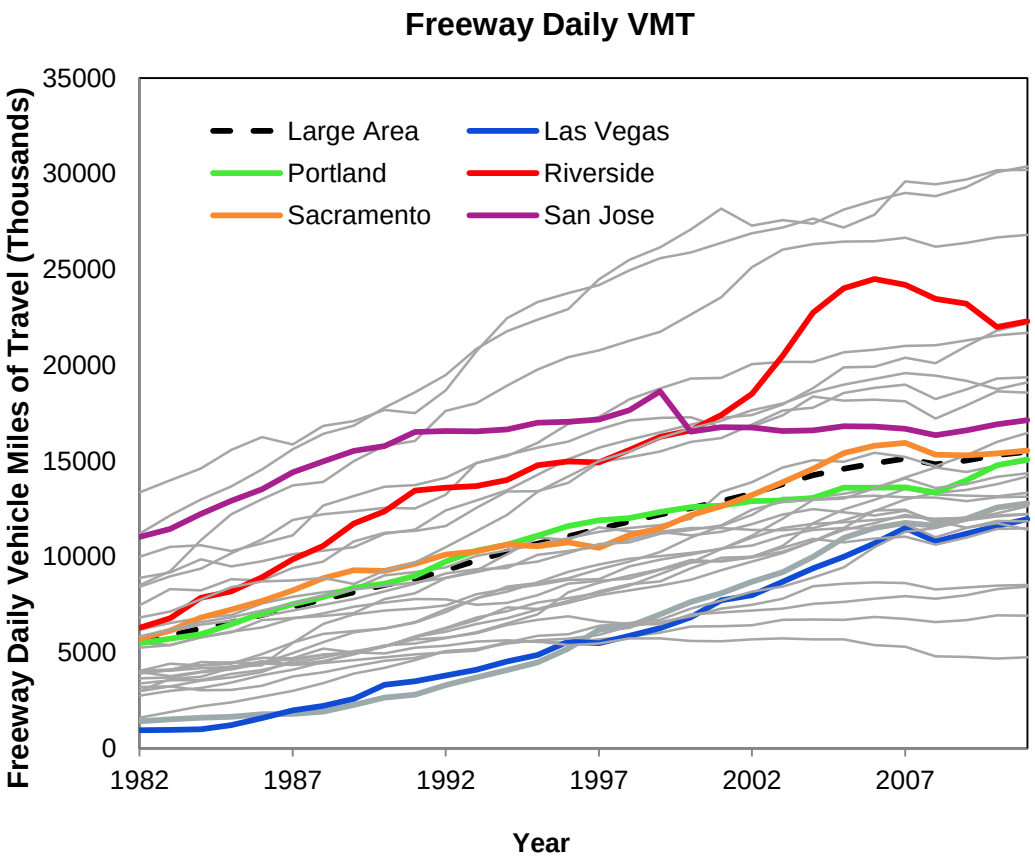


Data Source: 2012 Urban Mobility Report

(Figure 3-2)

Highway VMT Trends

This figure shows that daily VMT is increasing over time, but that Portland remains below average for the population group.



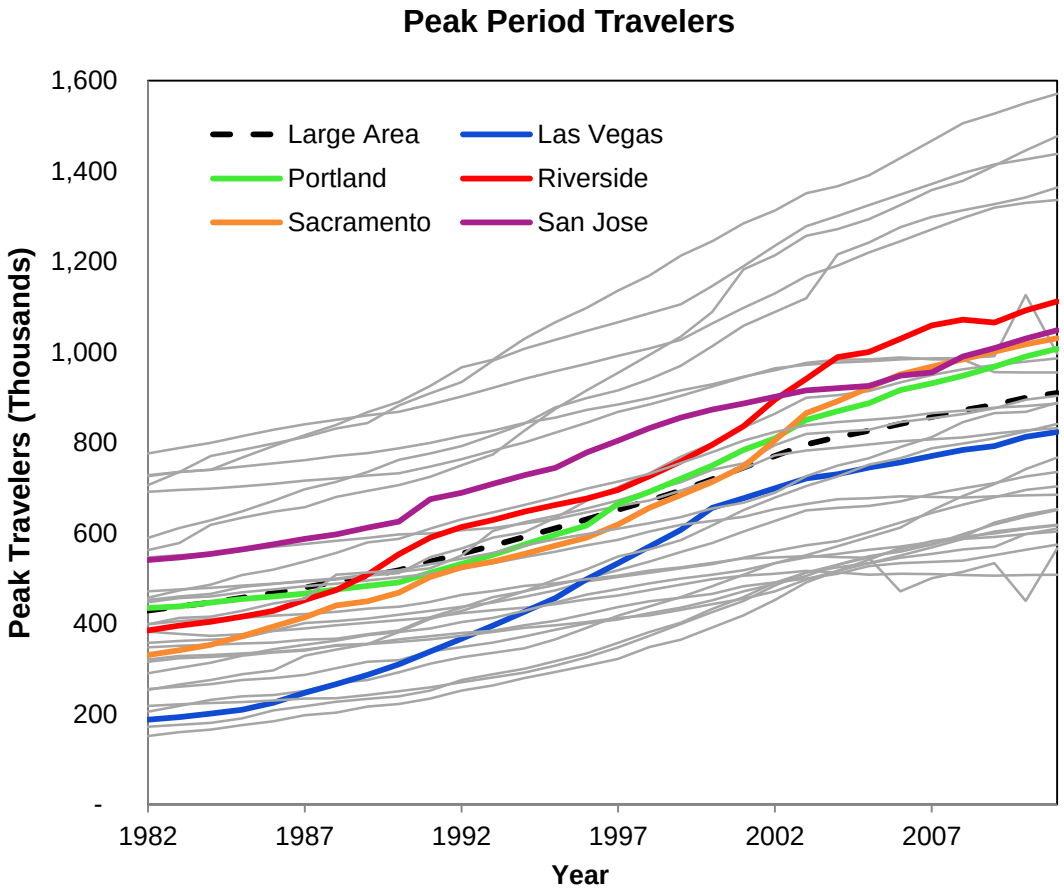
Data Source: 2012 Urban Mobility Report

Note: The drop in DVMT for San Jose in 2000 reflects a significant decrease in the quantity of freeway lane-miles measured for the urban area.

(Figure 3-3)

Number of Peak Period Travelers

This figure shows the number of peak period travelers. Portland-Vancouver has slowly been growing to be above average compared to other Large urban areas.

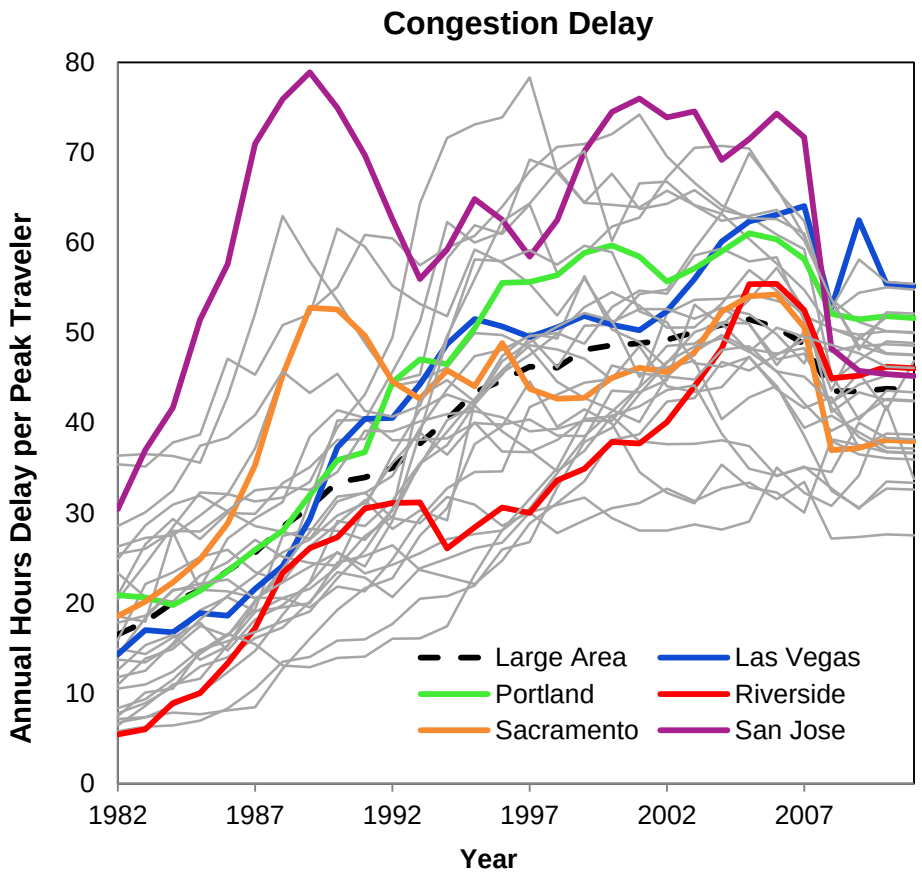


Data Source: 2012 Urban Mobility Report

(Figure 3-4)

Annual Congestion Trends

Annual congestion delay for peak period travelers in Portland has been close to the Large area average since 1982. It has exceeded the average since 1995. Shorter-than-average travel distance coupled with lower-than-average travel speed has leveled off the delay actually experienced by travelers.

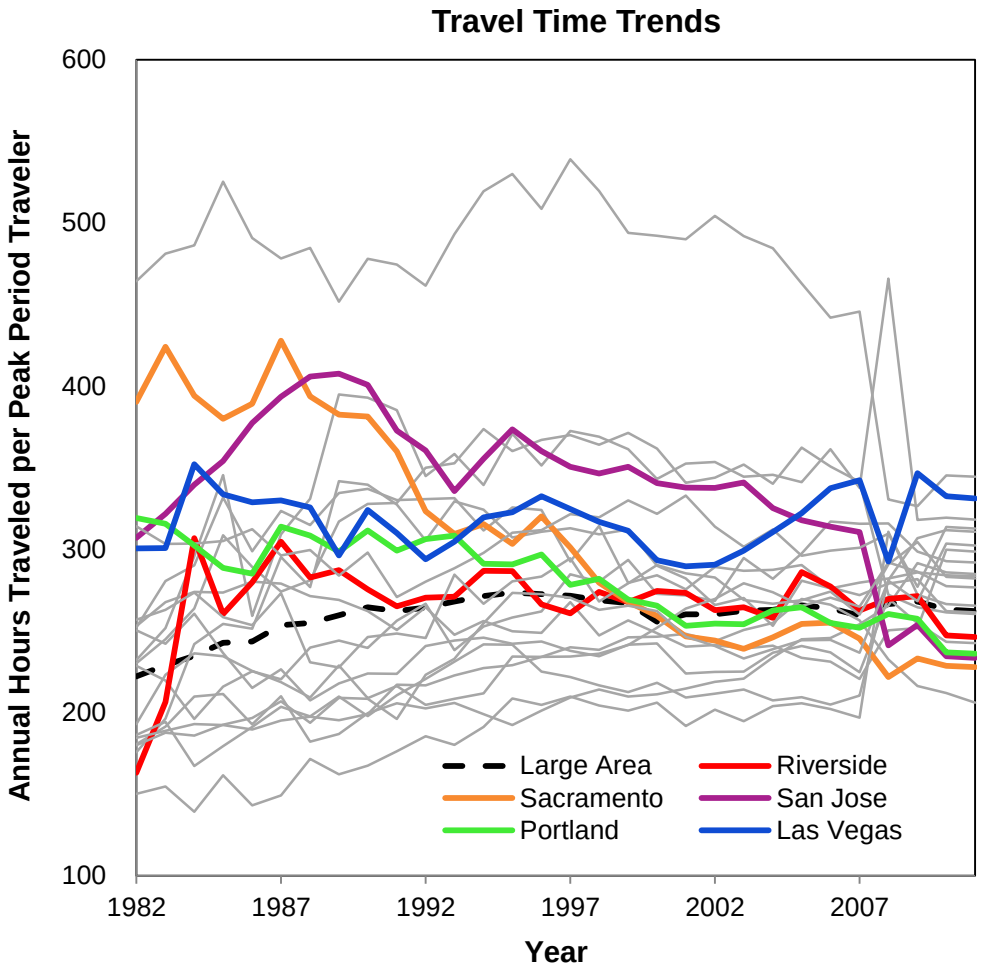


Data Source: 2012 Urban Mobility Report

(Figure 3-5)

Travel Time Trends

Portland annual travel time per peak period traveler has remained about average for Large areas since 2000. Again, shorter-than-average travel distance has eased the impact of congestion on travel time.

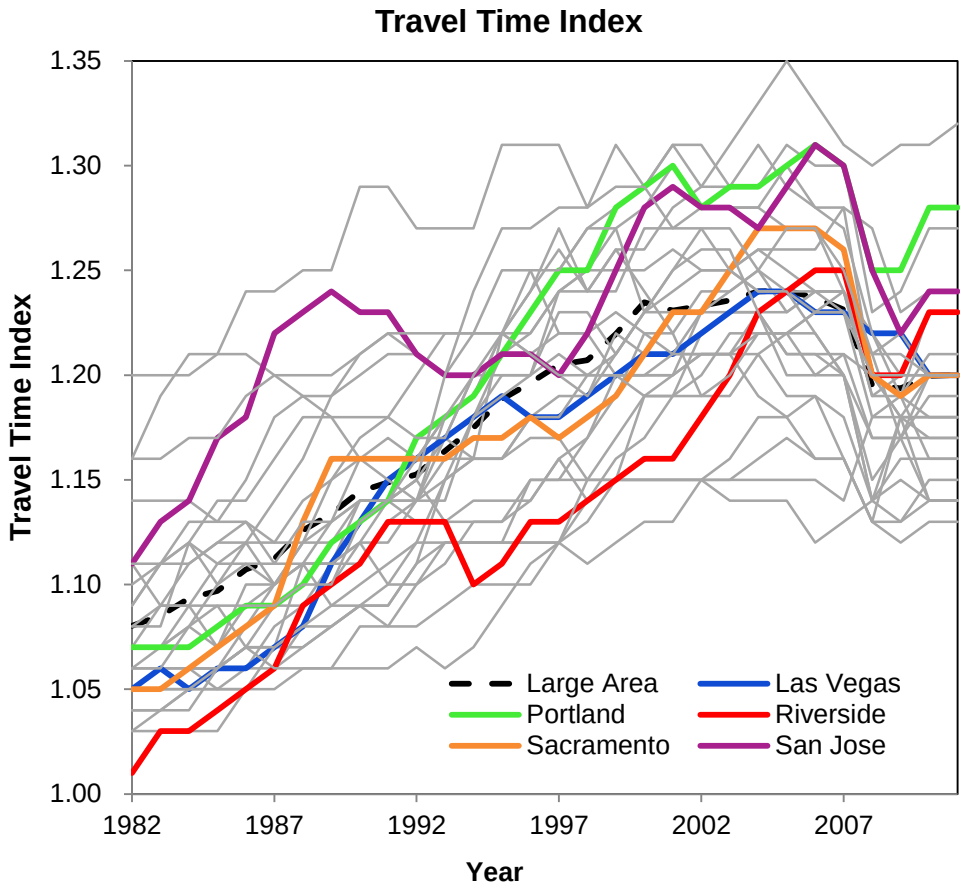


Data Source: 2012 Urban Mobility Report

(Figure 3-6)

Travel Time Index

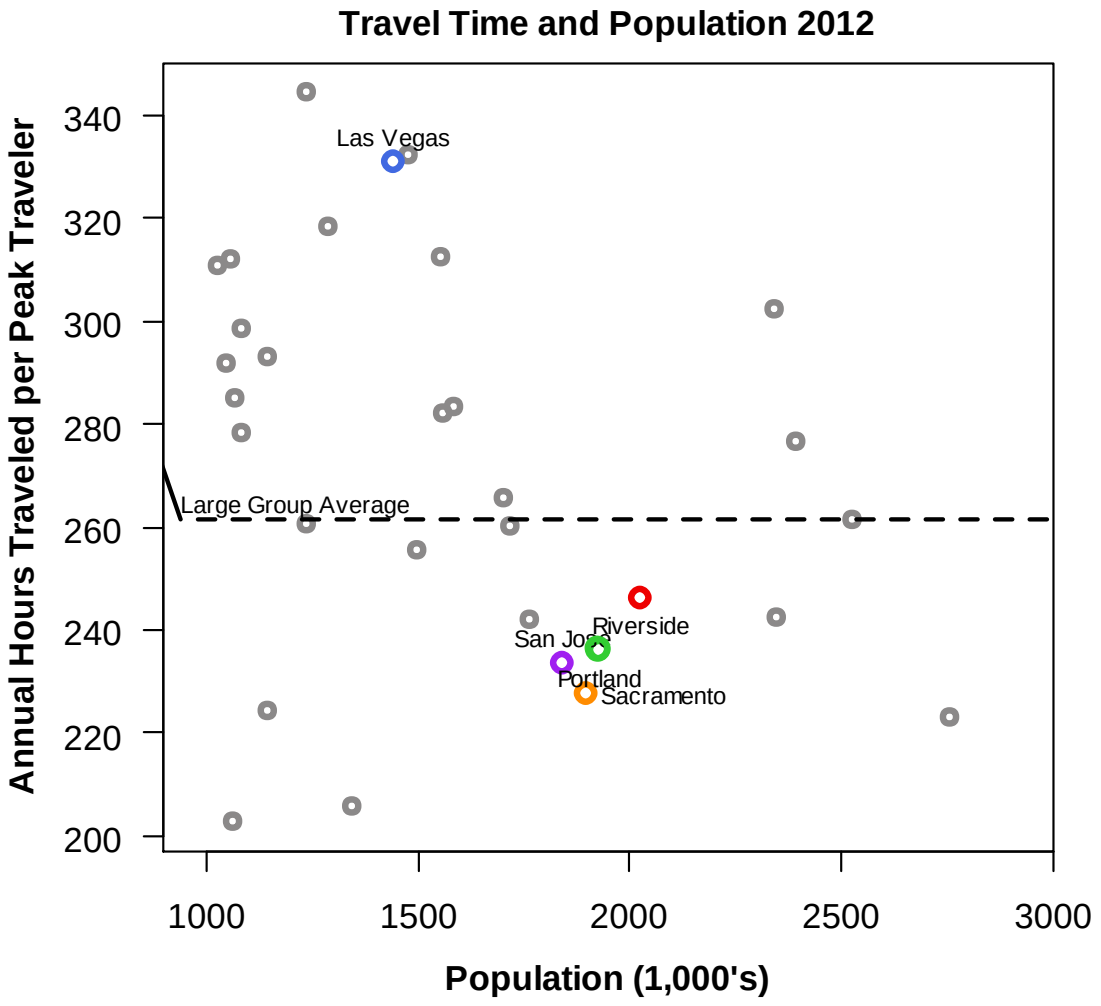
Travel Time Index (TTI) is an estimate of how much longer it takes on average to travel on the major road system during peak times vs. off-peak times. It considers the effects of everyday recurring congestion and the effects of congestions due to incidents. The TTI is the ratio of travel time in the peak period to the travel time at free-flow conditions. A value of 1.35 indicates a 20-minute free-flow trip takes 27 minutes in the peak.



(Figure 3-7)

Travel Time and Population

Portland's population is 7th out of the 32 Large areas, and the hours of travel per peak period traveler is well below average for Large areas.

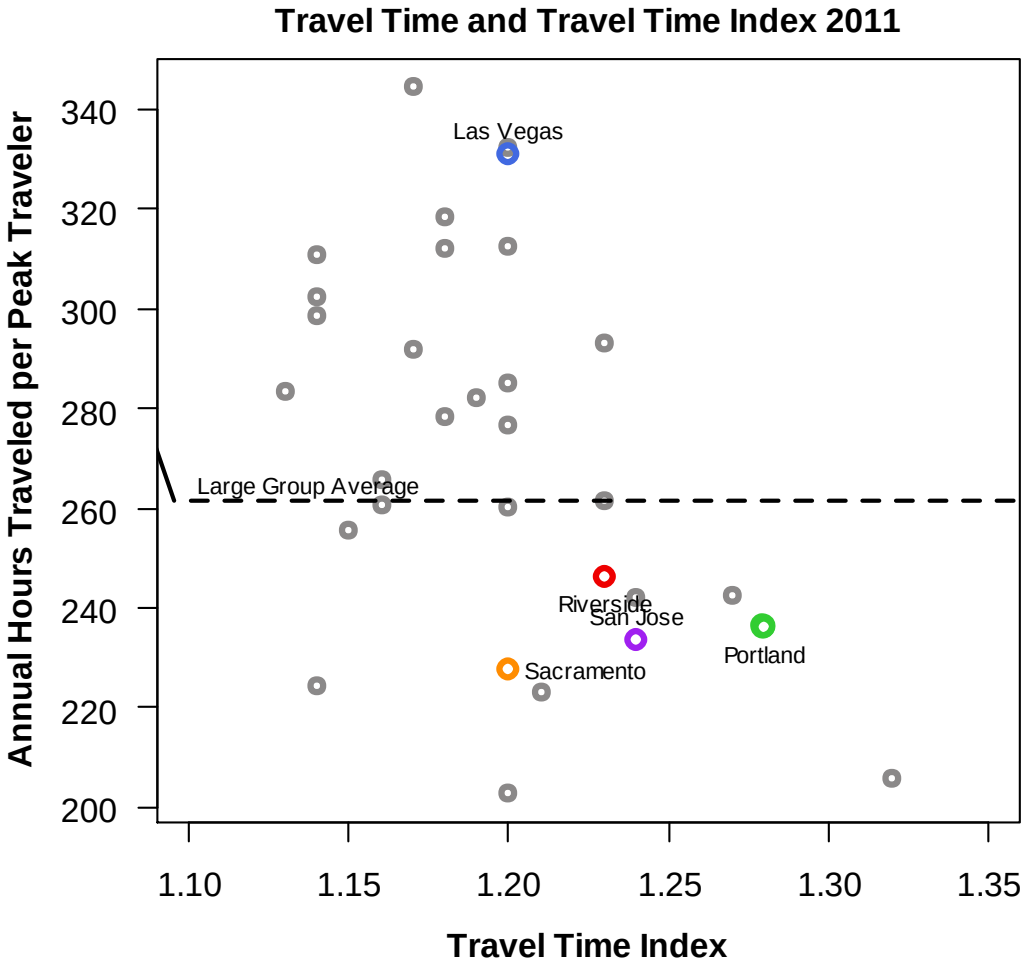


Data Source: 2012 Urban Mobility Report

(Figure 3-8)

Travel Time and Travel Time Index

The annual amount of travel per peak period traveler in Portland is among the 7 lowest when compared to other Large cities, while the Travel Time Index for Portland is among the top 2 of the 31 Large cities.

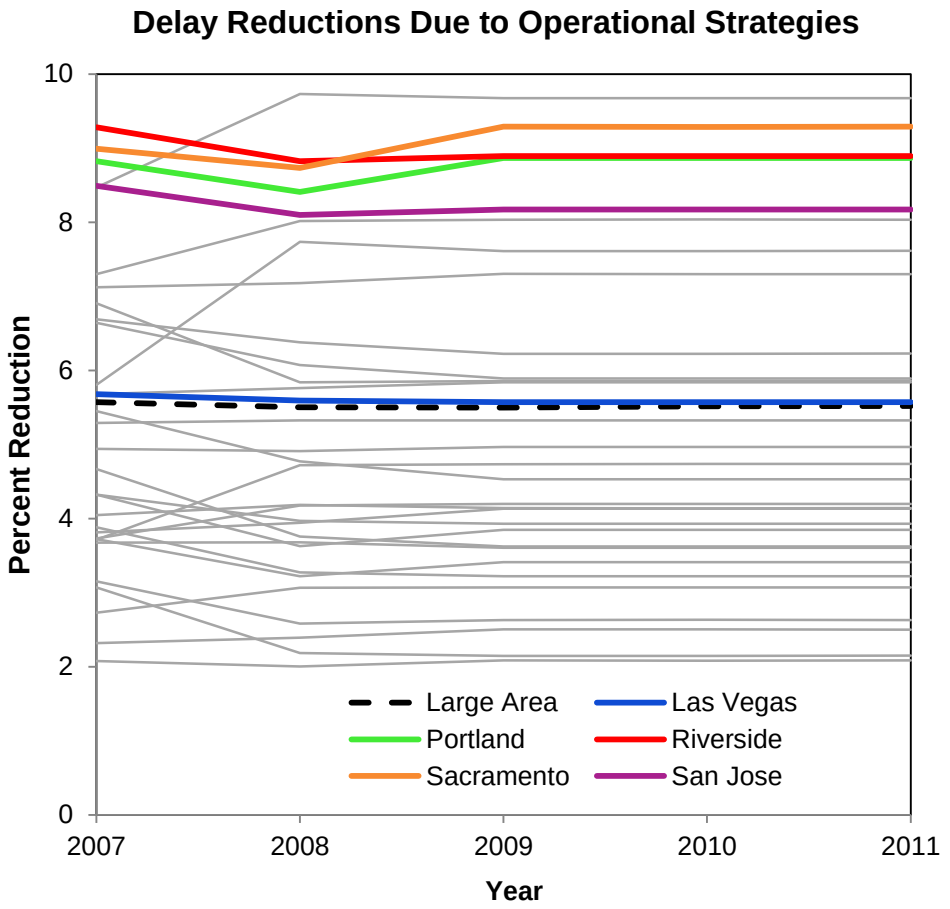


Data Source: 2012 Urban Mobility Report

(Figure 3-9)

Delay Reduction Due to Operational Strategies

The Urban Mobility Report estimates the delay reduction due to operational strategies such as incident management, freeway ramp metering and arterial traffic signal coordination. As shown, the percent reduction has remained fairly constant over the past 5 years.

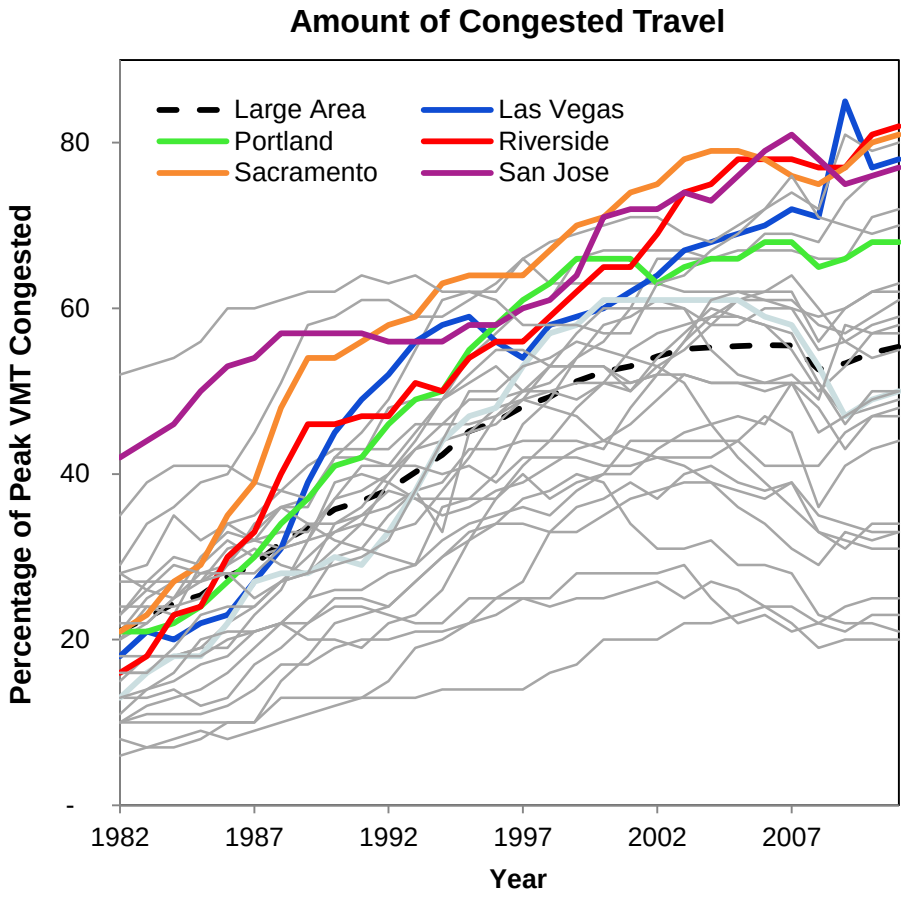


Data Source: 2012 Urban Mobility Report

(Figure 3-10)

Congestion During Peak Period

This figure shows the amount of congestion during the peak period as a percentage of peak period VMT. The Western cities show the greatest amount of congestion out of the Large urban area group, but the value is increasing for most cities.

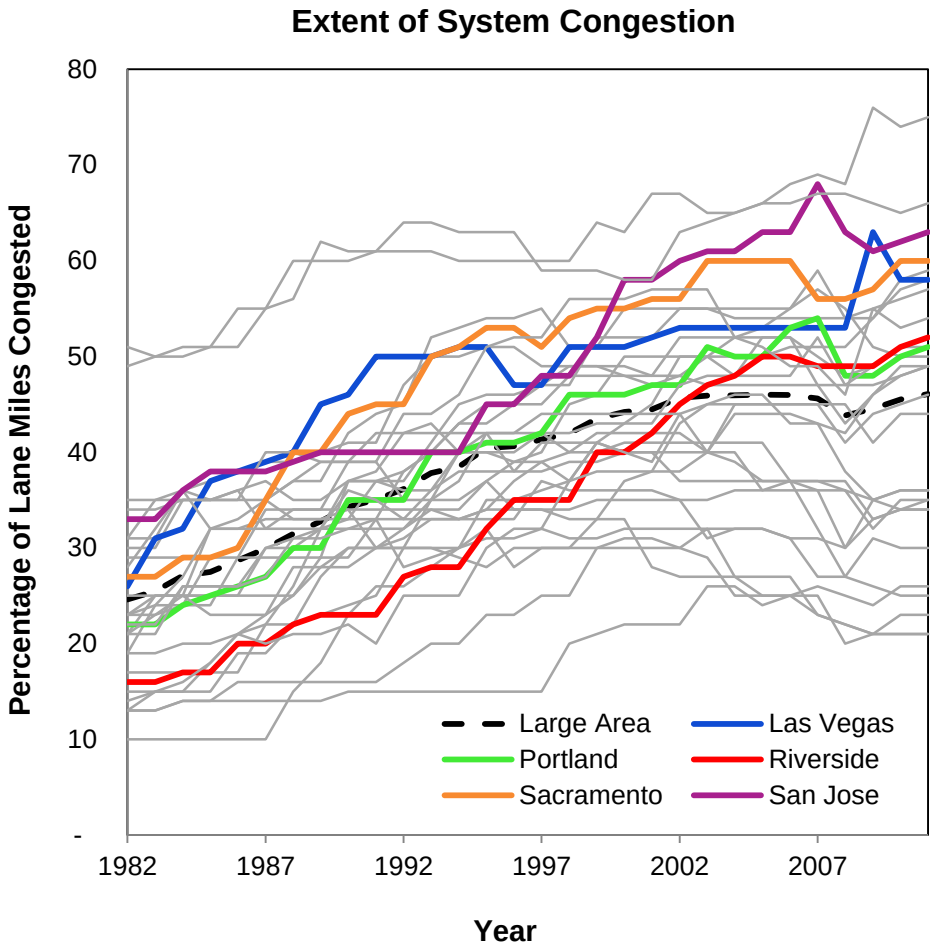


Data Source: 2012 Urban Mobility Report

(Figure 3-11)

Extent of Congestion

This figure shows the full extent of congestion. Again, the Western cities show the greatest amount of congestion out of the Large urban area group, but the value is increasing for most cities.

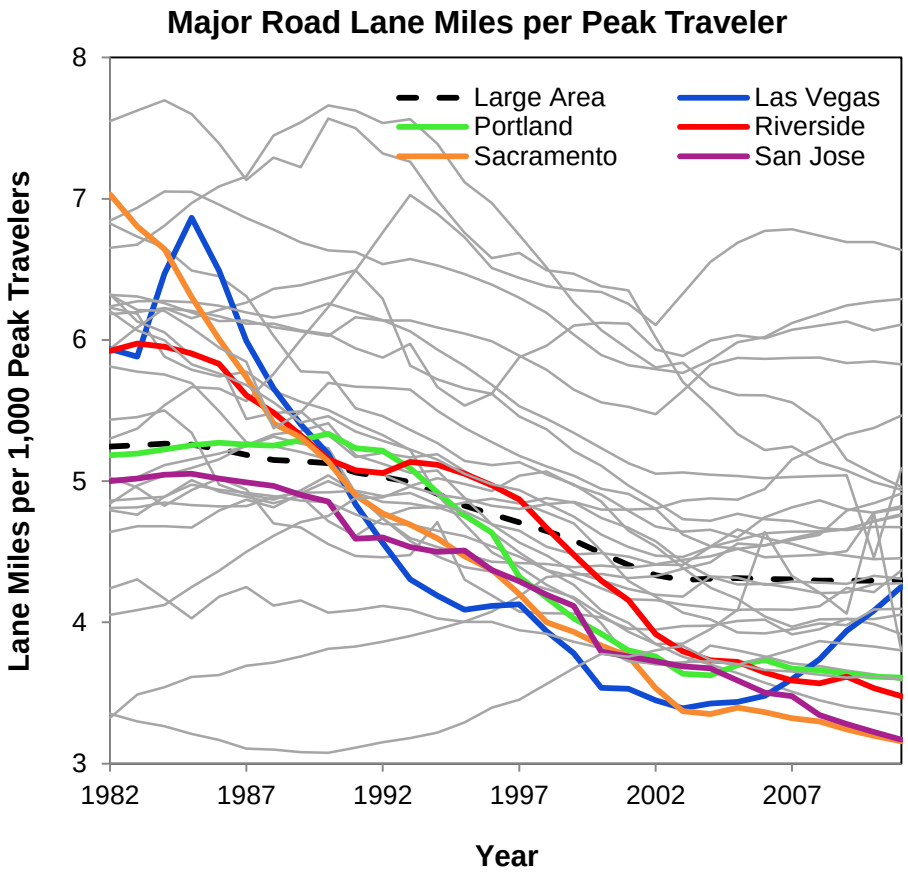


Data Source: 2012 Urban Mobility Report

(Figure 3-12)

Roadway Per Peak Traveler

One of the causes of increased congestion is a reduction in the roadway lane-miles per traveler as populations increase faster than new roadway is built. As Western cities have the greatest congestion, they also have the least roadway per peak traveler.

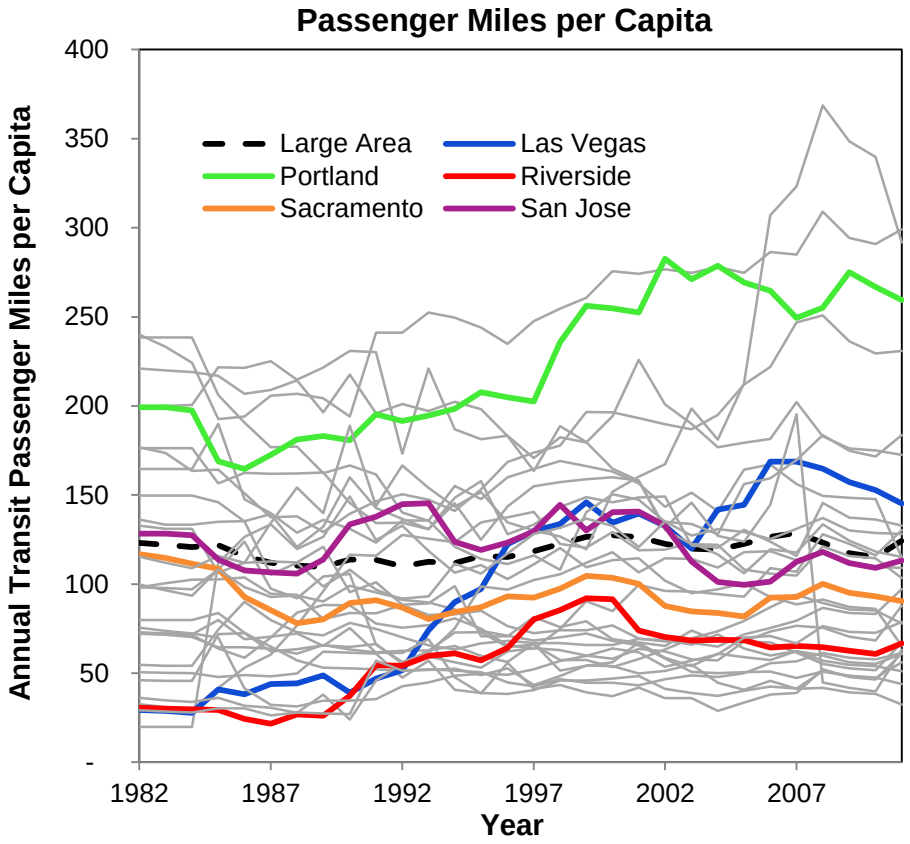


Data Source: 2012 Urban Mobility Report

(Figure 3-13)

Transit Miles Per Capita

This figure shows the annual number of public transit passenger miles traveled per capita. Portland is in the top three for most transit passenger miles traveled per capita.

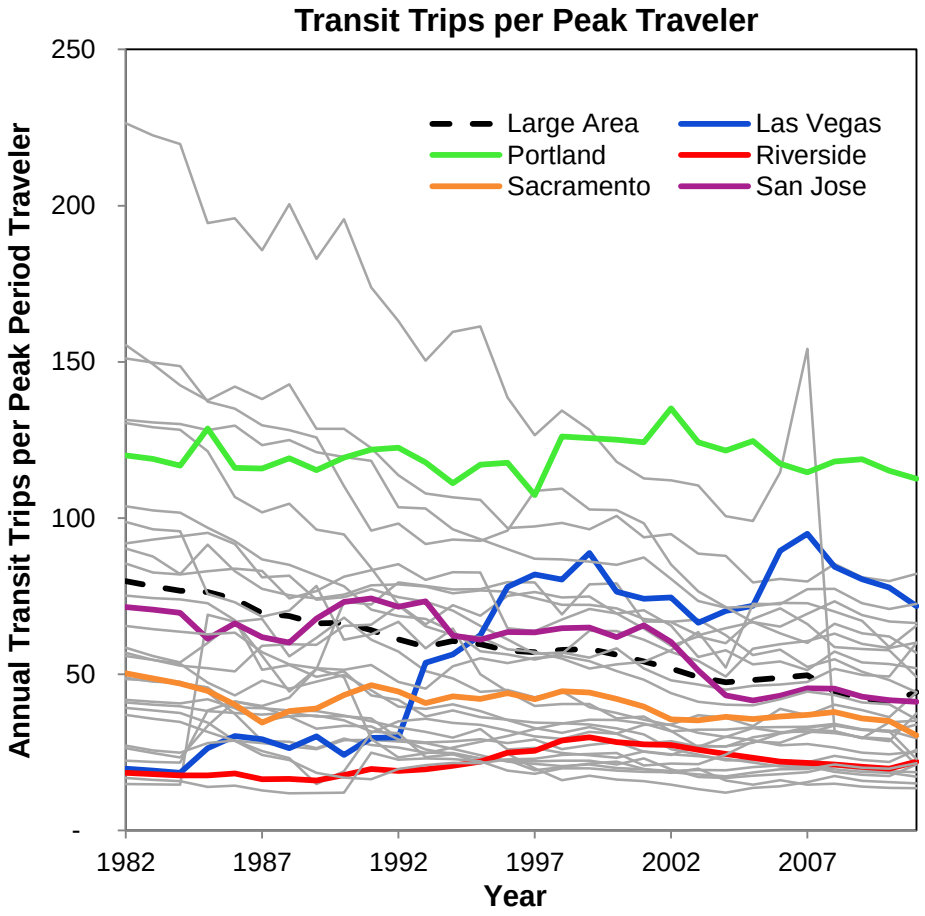


Data Source: 2012 Urban Mobility Report

(Figure 3-14)

Transit Trips Per Peak Traveler

This figure shows the annual number of public transit trips per peak period traveler. By this measure, Portland has had the most transit use in the Large urban area for the past 5 years.

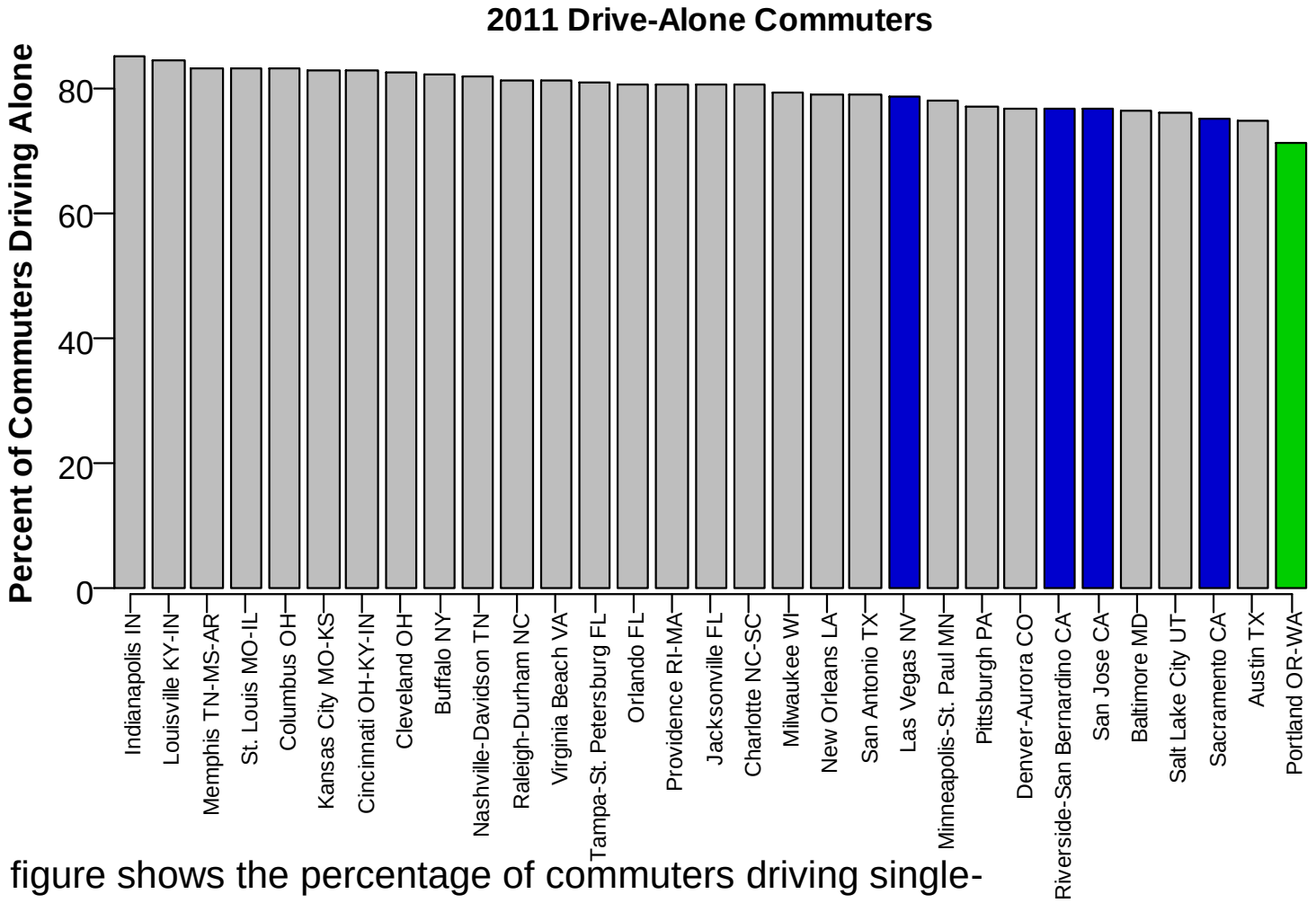


Data Source: 2012 Urban Mobility Report

(Figure 3-15)

Drive Alone Commuters

Data Source: American Community Survey, U.S. Census



This figure shows the percentage of commuters driving single-occupancy vehicles in 2011. Portland has the lowest percentage in the Large urban area group.

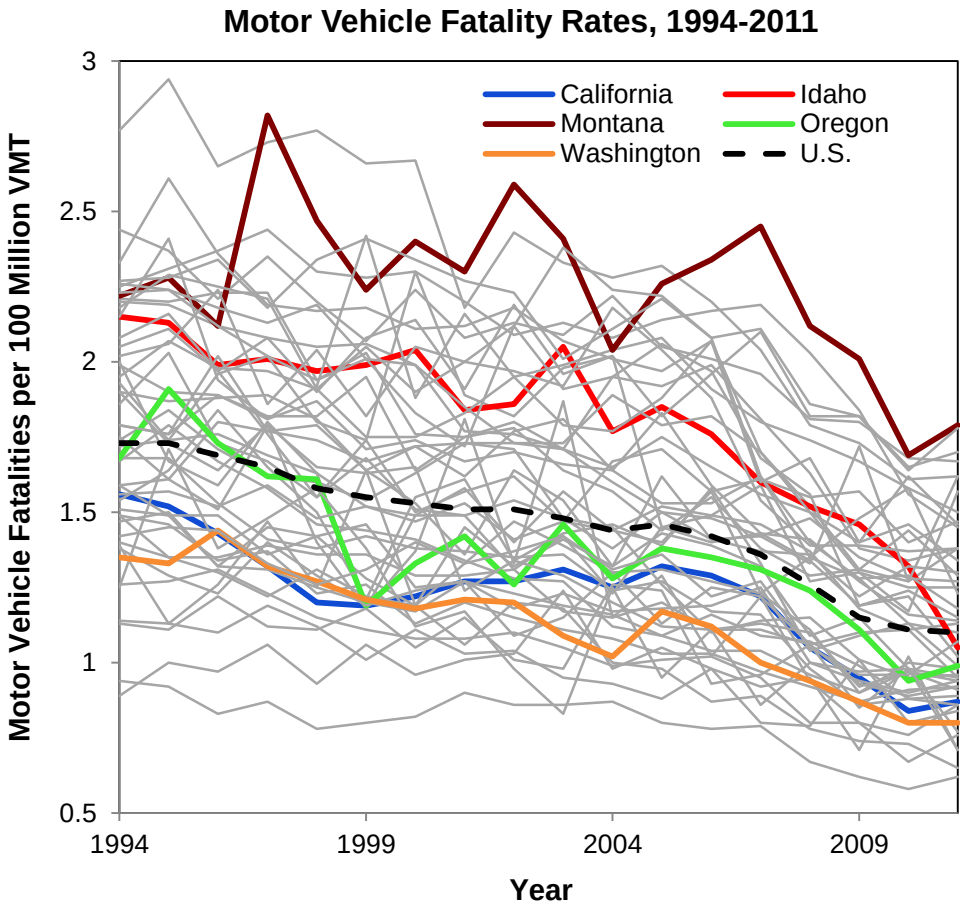
(Figure 3-16)

Safety Trends

Using methods suggested by the 2004 Statewide Congestion Overview, this section examines recent transportation safety trends.

National Motor Vehicle Crash Trends

This figure shows a comparison of motor vehicle fatality rates per 100 million vehicle miles traveled for all 50 US states. Although fatal crashes represent only a portion of the total safety performance, they provide a useful benchmark for comparison. Oregon rates have generally been below the national average.

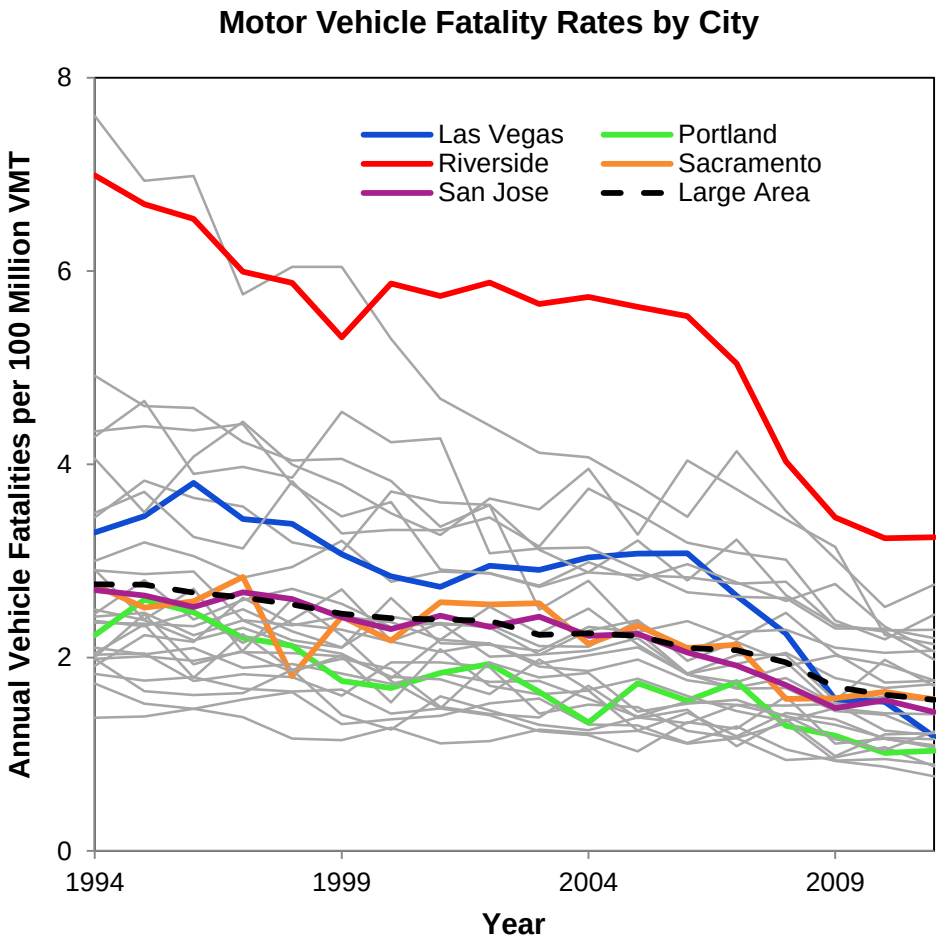


Data Source: National Highway Traffic Safety Administration (NHTSA), Fatality Analysis and Reporting System (FARS)

(Figure 4-1)

Motor Vehicle Safety

This figure shows an urban area comparison of motor vehicle fatality rates expressed per 100 million VMT. The Portland urban area is below average for the Large population group.

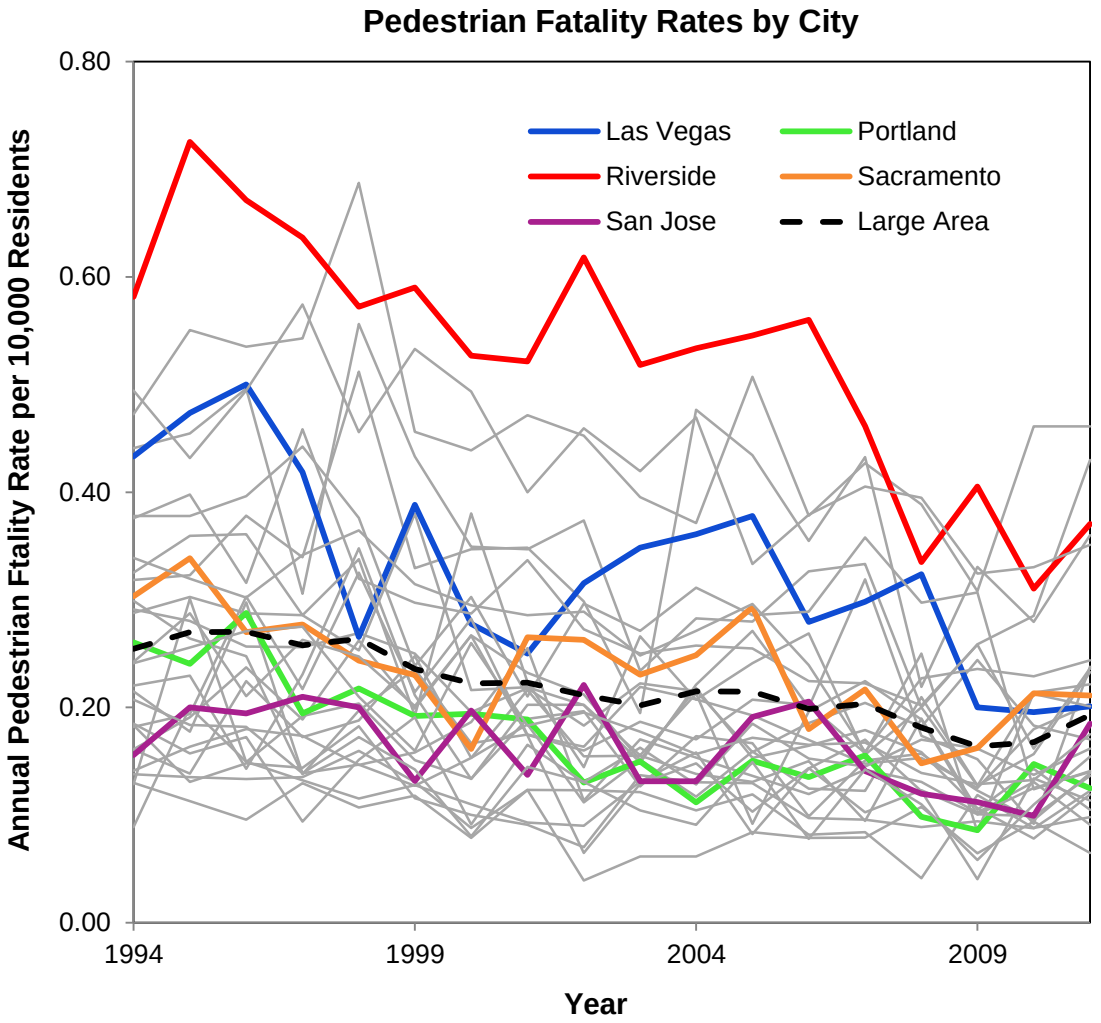


Data Sources: NHTSA FARS, 2012 Urban Mobility Report

(Figure 4-2)

Pedestrian Safety

This figure shows an urban area comparison of pedestrian fatality rates expressed per 10,000 people. The Portland urban area is below average for the Large population group.

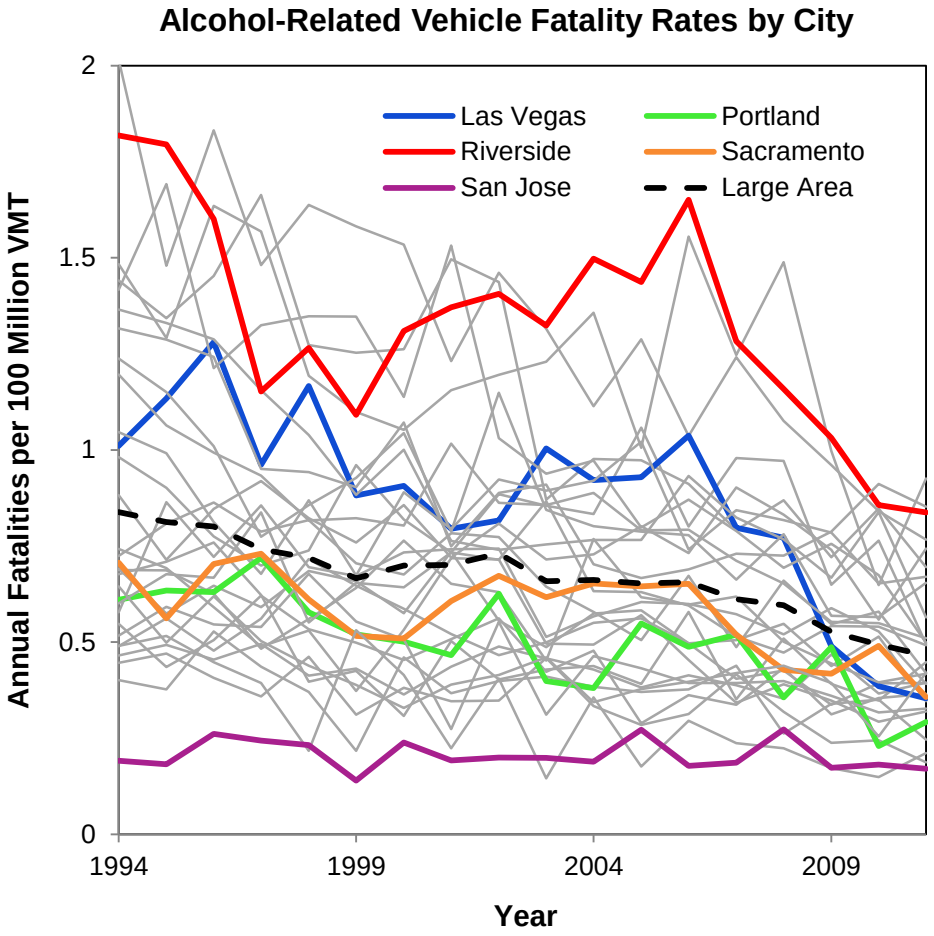


Data Source: NHTSA FARS, U.S. Census Journey to Work, 2012 Urban Mobility Report

(Figure 4-3)

Alcohol-Related Fatality Rates

This figure shows alcohol-related fatality rates for Large urban areas, as defined by the Urban Mobility Report. Portland is below average for the Large population group.

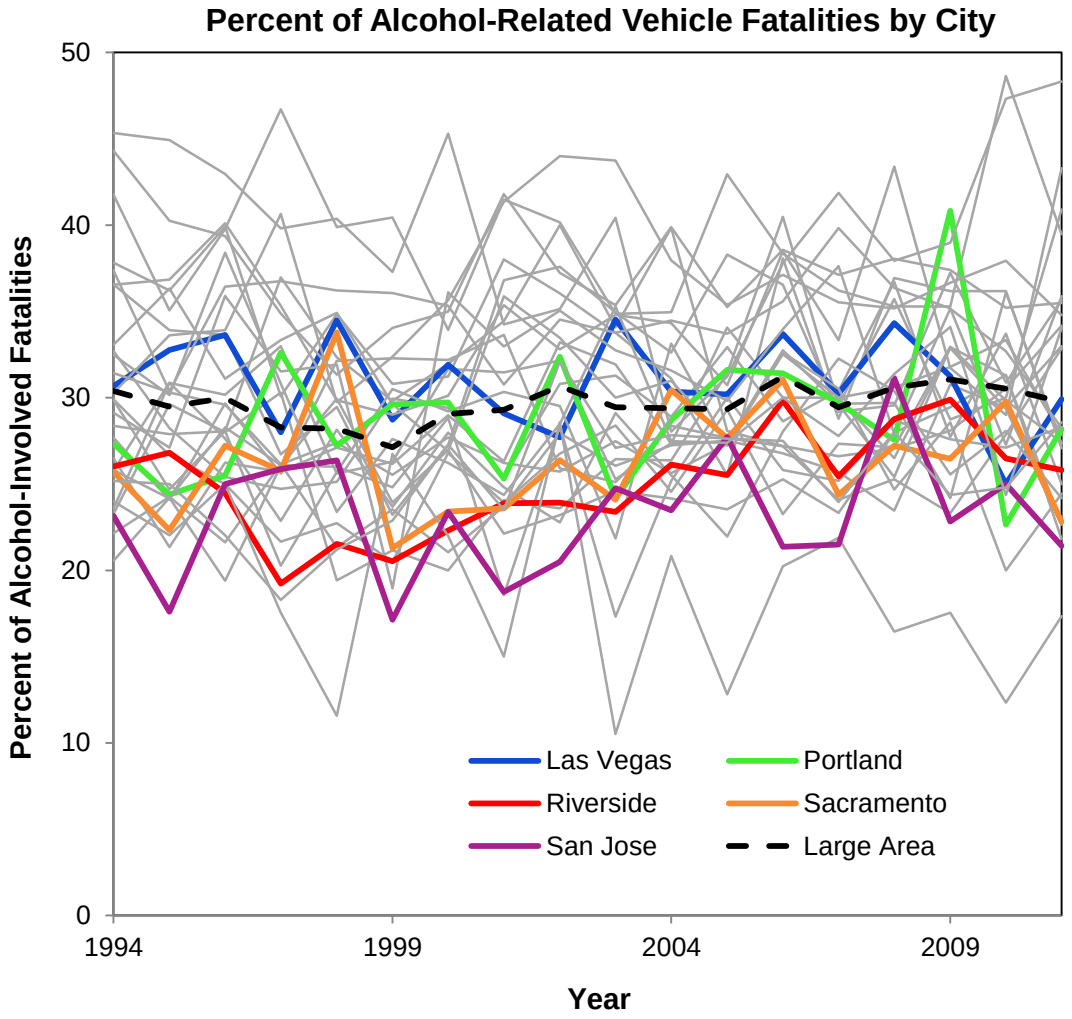


Data Source: NHTSA, FARS

(Figure 4-4)

Alcohol-Related Fatality Rates

Alcohol-related crashes typically account for about one third of motor vehicle fatalities. This figure shows the percent of alcohol-related vehicle fatalities for Large urban areas. Although Portland is below average for its alcohol-related fatality rates, it is near average for the percentage of total fatalities that are alcohol-related.

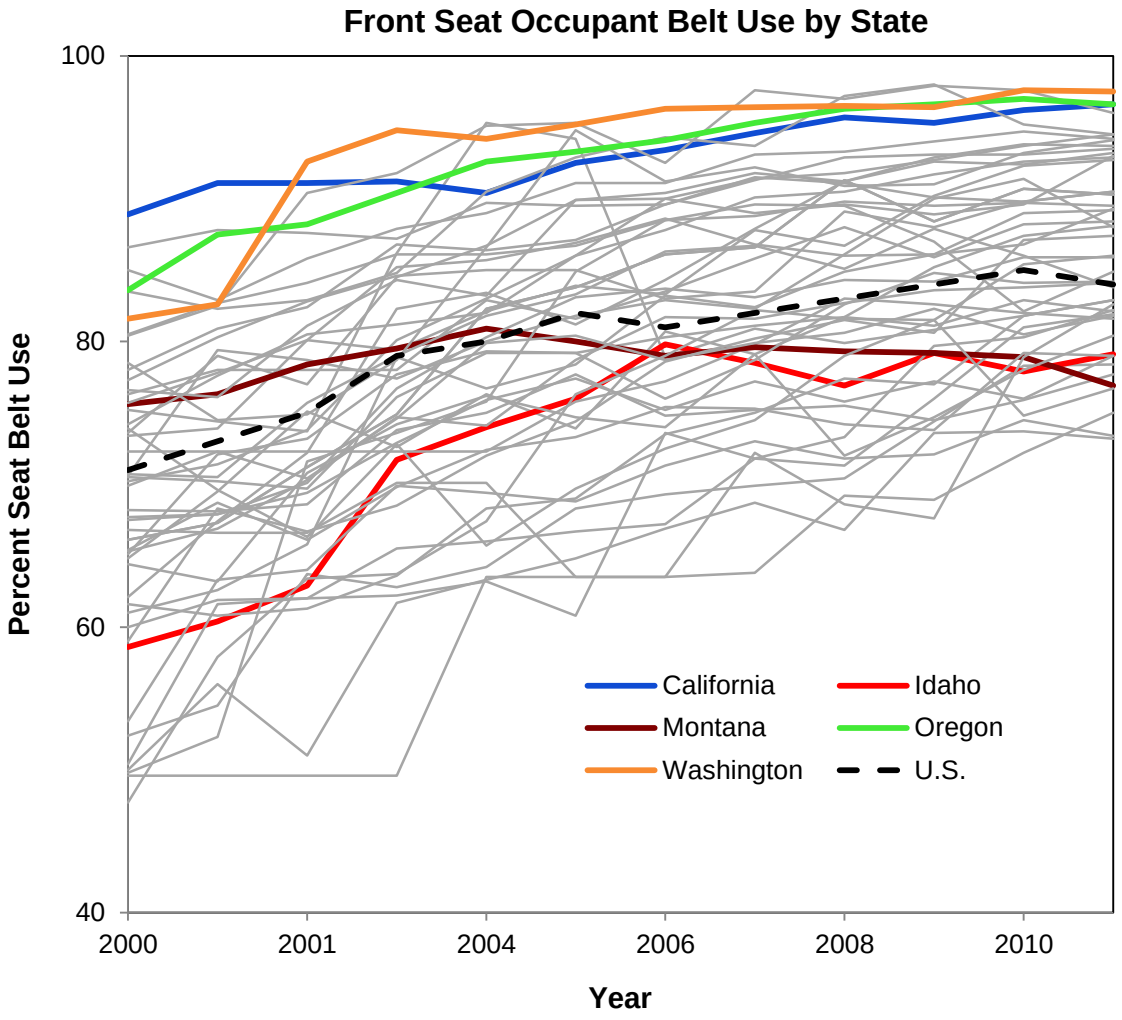


Data Source: National Highway Traffic Safety Administration (NHTSA), Fatality Analysis and Reporting System (FARS)

(Figure 4-5)

Safety Belt Use By State

Safety belts are known to reduce crash fatalities or crash injury severity for front seat occupants. This figure shows a high percentage of seat belt use for the three Pacific Coast states, and increasing usage nationwide.

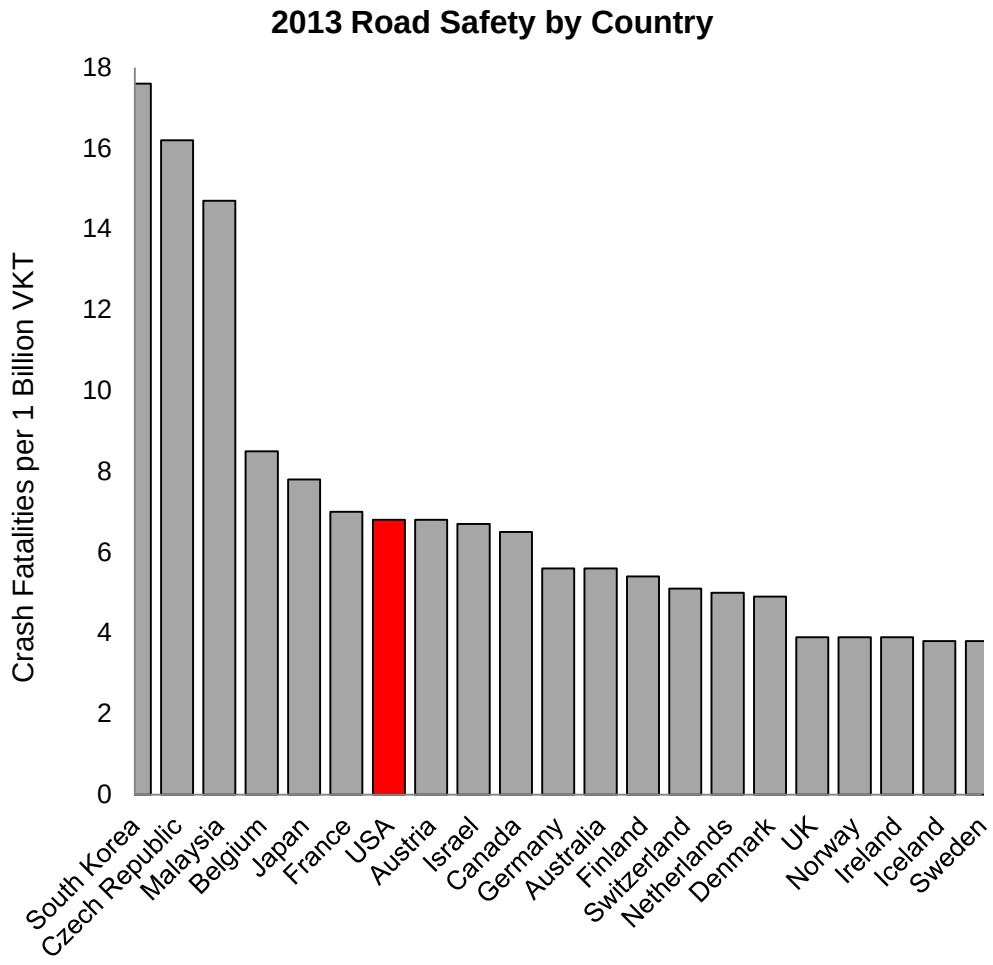


Data Source: USDOT, National Highway Traffic Safety Administration

(Figure 4-6)

International Motor Vehicle Safety Comparison

For an international safety context, this figure shows a combined motor vehicle injury and fatality rate per billion vehicle kilometers traveled for various nations.



Data Source: International Road Traffic and Accident Database

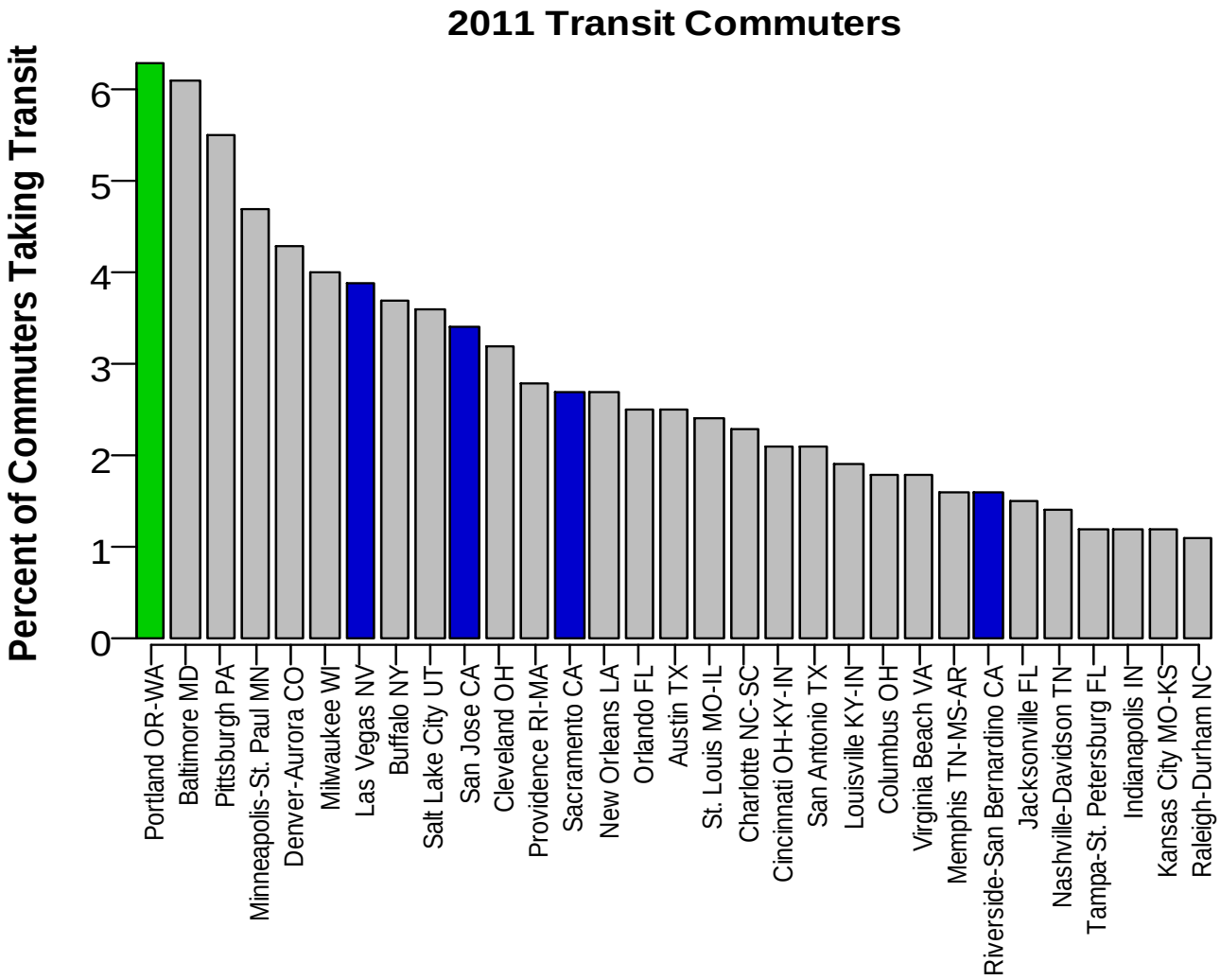
(Figure 4-7)

Portland Region Transit and Non-Motorized Transportation Trends

Using methods suggested by the 2004 Statewide Congestion Overview, this section examines recent trends in transit ridership and non-motorized transportation in the Portland region.

Transit Market Share

Data Source: American Community Survey, U.S. Census

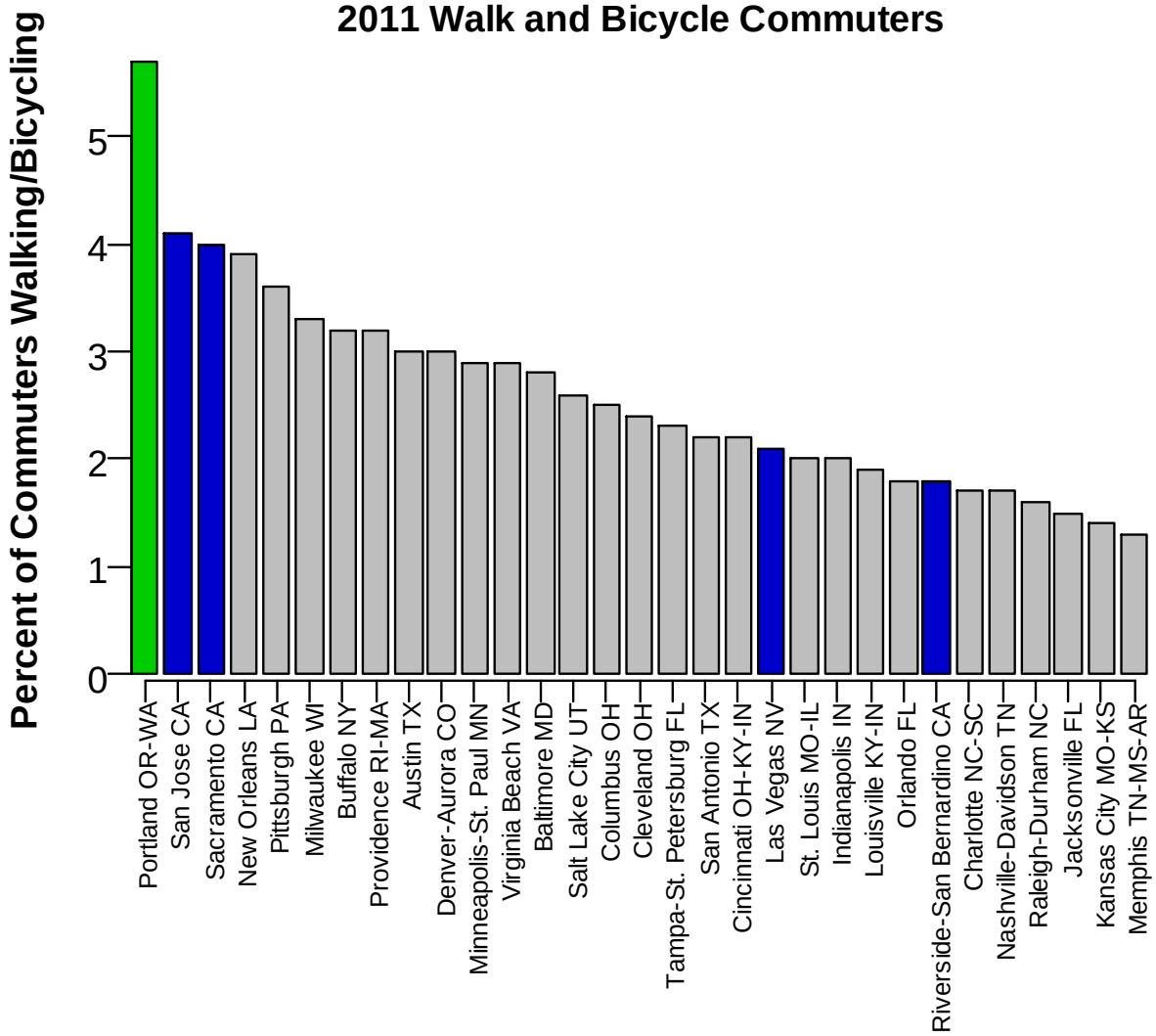


This figure shows the percent of commuters using transit in 2011. Portland has the highest percentage in the Large urban area group with over 6%.

(Figure 5-1)

Non-Motorized Commuting

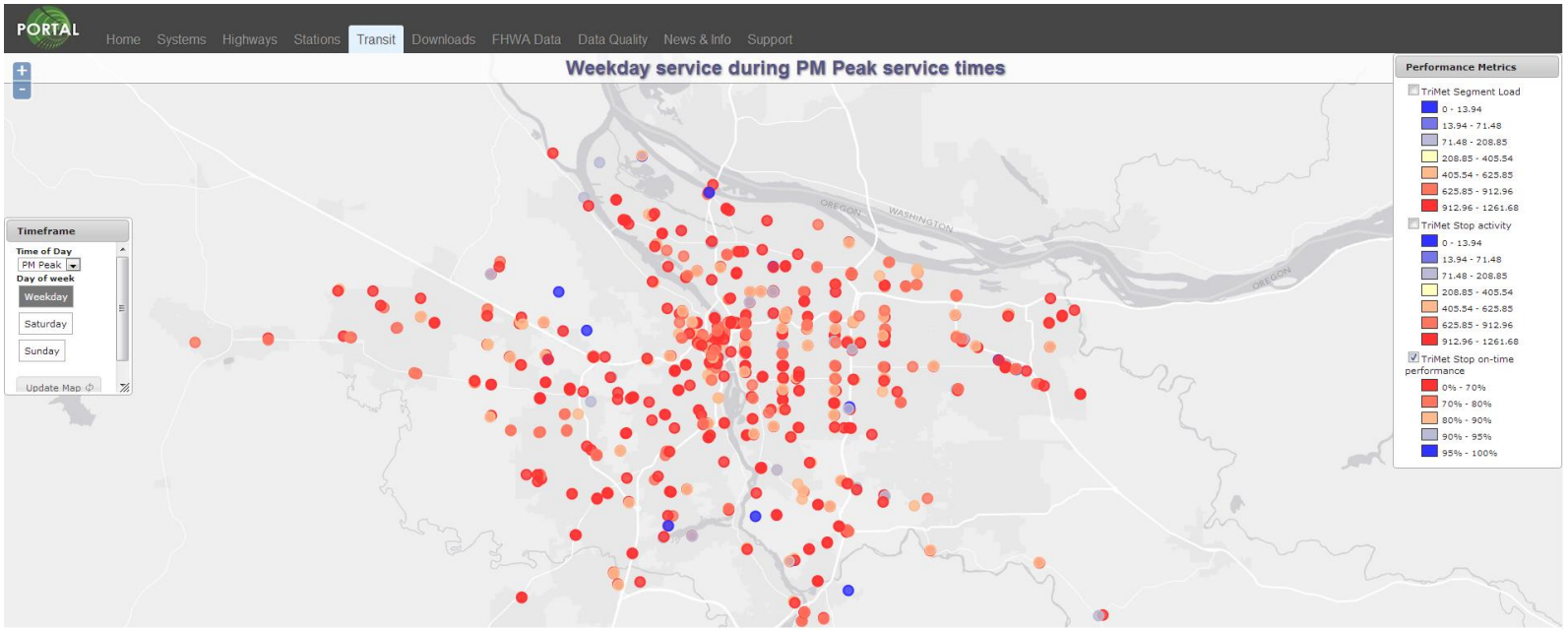
Data Source: American Community Survey, U.S. Census



This figure shows the percent of commuters walking and bicycling in 2011. Portland by far has the highest percentage in the Large urban area group with over 5%. **(Figure 5-2)**

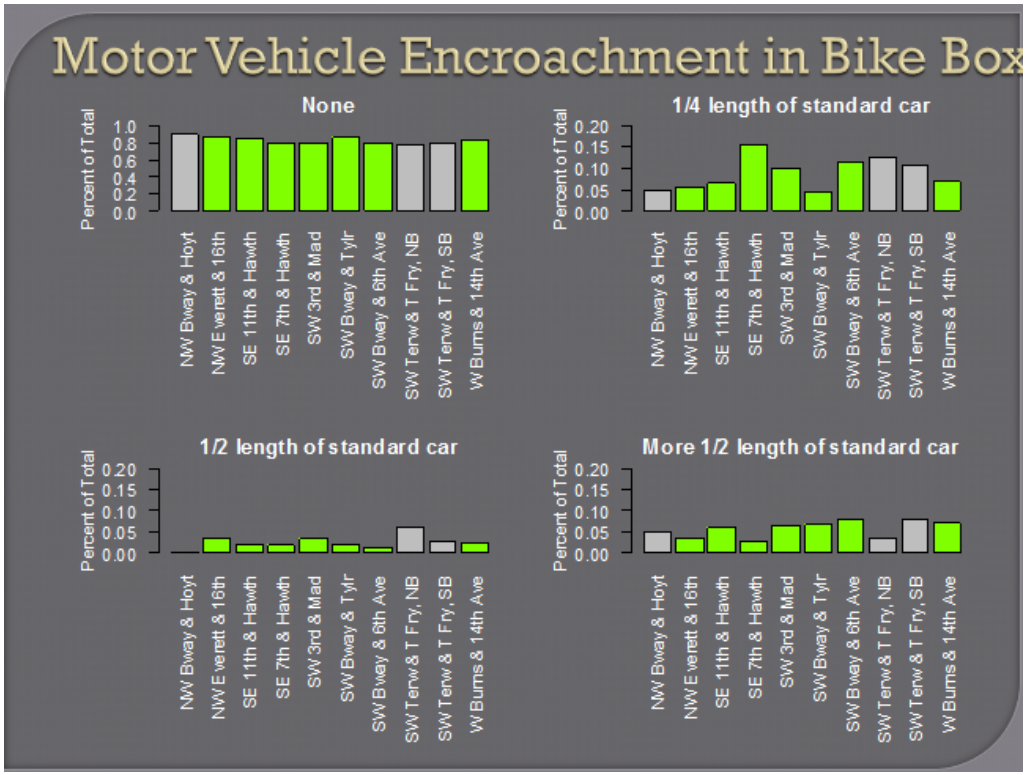
Future Data Sources

This section describes future data sources that will assist in preparation of future editions of this report. Portland State University is now the Portland region's official data archive for intelligent transportation systems data. The image below shows the percentage of TriMet stops that are on-time during a weekday peak PM time, with red dots designating poor on-time performance and blue dots signifying good on-time performance.



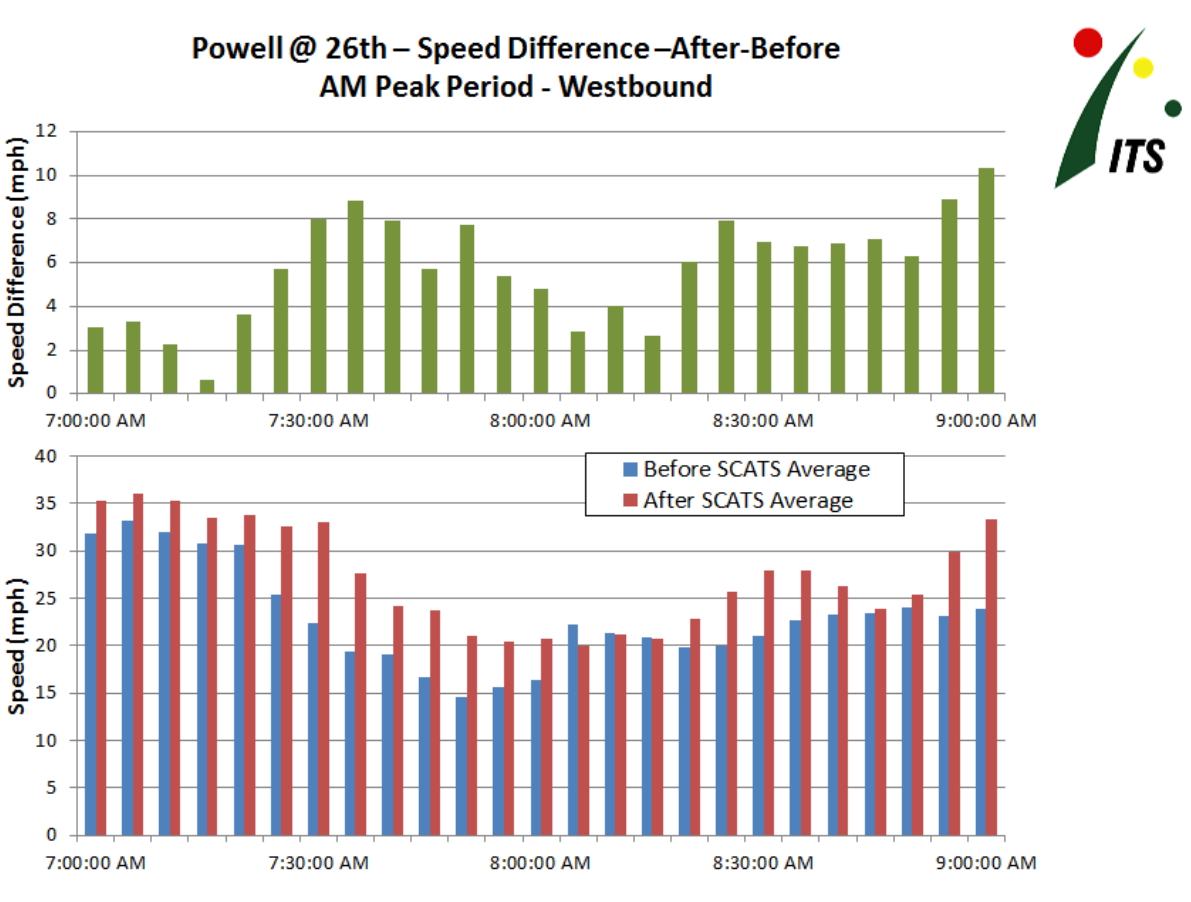
Bicycle Infrastructure Data

Portland has a sophisticated bicycle infrastructure system that is constantly growing up and producing valuable new sources of data. This figure shows some charts demonstrating the prevalence of motor vehicle encroachment in Portland's bike boxes, a relatively recent addition to the transportation system.



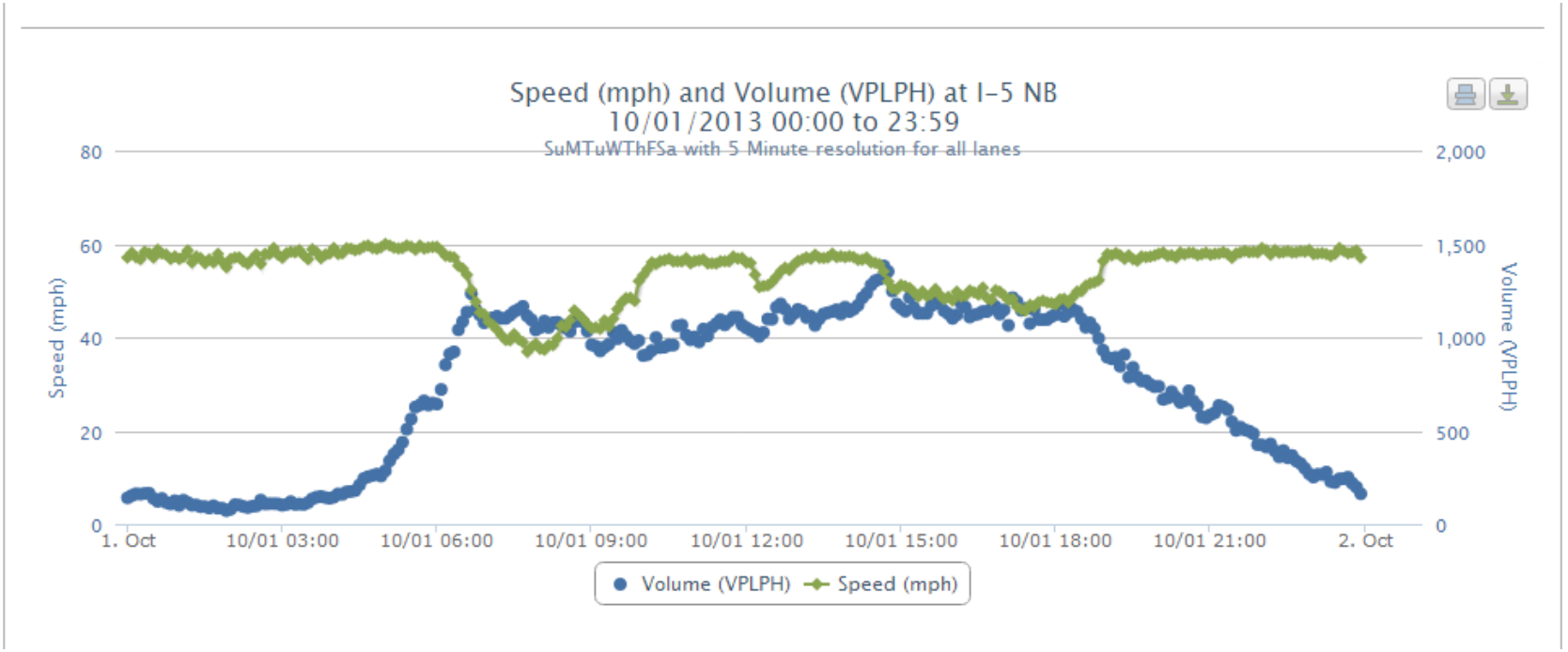
Sydney Coordinated Adaptive Traffic System (SCATS)

This figure demonstrates the findings of a recent study of the impacts of the newly installed SCATS on congestion levels in Portland performed by researchers at Portland State. The charts show a clear increase in speeds after the installation of SCATS.



Freeway Traffic Volume Trends

These figures show actual traffic volume data for I-5 northbound recorded on October 1 2013. The green points represent observed speeds at 5-minute intervals throughout the day, and the blue points represent observed volumes in vehicles per lane per hour.



Closure

In this report we have attempted to present a wide array of methods for assessing the performance of the Portland transportation system, using analysis of available data. We hope that this has contributed to the important debate regarding the kind of transportation system, quality of life, and region that we want to have in the future.